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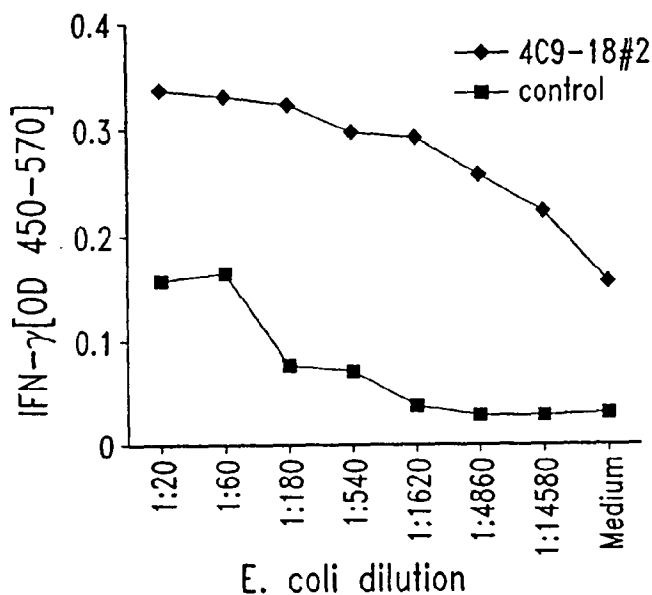
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[Continued on next page]

(54) Title: COMPOUNDS AND METHODS FOR TREATMENT AND DIAGNOSIS OF CHLAMYDIAL INFECTION



(57) Abstract: Compounds and methods for the diagnosis and treatment of Chlamydial infection are disclosed. The compounds provided include polypeptides that contain at least one antigenic portion of a *Chlamydia* antigen and DNA sequences encoding such polypeptides. Pharmaceutical compositions and vaccines comprising such polypeptides or DNA sequences are also provided, together with antibodies directed against such polypeptides. Diagnostic kits containing such polypeptides or DNA sequences and a suitable detection reagent may be used for the detection of Chlamydial infection in patients and in biological samples.



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## COMPOUNDS AND METHODS FOR TREATMENT AND DIAGNOSIS OF CHLAMYDIAL INFECTION

### TECHNICAL FIELD

The present invention relates generally to the detection and treatment of  
5 Chlamydial infection. In particular, the invention is related to polypeptides comprising  
a *Chlamydia* antigen and the use of such polypeptides for the serodiagnosis and  
treatment of Chlamydial infection.

### BACKGROUND OF THE INVENTION

Chlamydiae are intracellular bacterial pathogens that are responsible for  
10 a wide variety of important human and animal infections. *Chlamydia trachomatis* is  
one of the most common causes of sexually transmitted diseases and can lead to pelvic  
inflammatory disease (PID), resulting in tubal obstruction and infertility. *Chlamydia*  
*trachomatis* may also play a role in male infertility. In 1990, the cost of treating PID in  
the US was estimated to be \$4 billion. Trachoma, due to ocular infection with  
15 *Chlamydia trachomatis*, is the leading cause of preventable blindness worldwide.  
*Chlamydia pneumonia* is a major cause of acute respiratory tract infections in humans  
and is also believed to play a role in the pathogenesis of atherosclerosis and, in  
particular, coronary heart disease. Individuals with a high titer of antibodies to  
*Chlamydia pneumonia* have been shown to be at least twice as likely to suffer from  
20 coronary heart disease as seronegative individuals. Chlamydial infections thus  
constitute a significant health problem both in the US and worldwide.

Chlamydial infection is often asymptomatic. For example, by the time a  
woman seeks medical attention for PID, irreversible damage may have already occurred  
resulting in infertility. There thus remains a need in the art for improved vaccines and  
25 pharmaceutical compositions for the prevention and treatment of *Chlamydia* infections.  
The present invention fulfills this need and further provides other related advantages.

### SUMMARY OF THE INVENTION

The present invention provides compositions and methods for the  
diagnosis and therapy of *Chlamydia* infection. In one aspect, the present invention  
30 provides polypeptides comprising an immunogenic portion of a *Chlamydia* antigen, or a  
variant of such an antigen. Certain portions and other variants are immunogenic, such  
that the ability of the variant to react with antigen-specific antisera is not substantially  
diminished. Within certain embodiments, the polypeptide comprises an amino acid

sequence encoded by a polynucleotide sequence selected from the group consisting of (a) a sequence of SEQ ID NO: 1, 15, 21-25, 44-64, 66-76, 79-88, 110-119, 120, 122, 124, 126, 128, 130, 132, 134, 136, 169-174, 181-188, 263, 265 and 267-290; (b) the complements of said sequences; and (c) sequences that hybridize to a sequence of (a) or (b) under moderately stringent conditions. In specific embodiments, the polypeptides of the present invention comprise at least a portion of a *Chlamydial* protein that includes an amino acid sequence selected from the group consisting of sequences recited in SEQ ID NO: 5-14, 17-20, 26, 28, 30-32, 34, 39-43, 65, 89-109, 138-158, 167, 168, 224-262, 246, 247, 254-256, 292, 294-305 and variants thereof.

10 The present invention further provides polynucleotides that encode a polypeptide as described above, or a portion thereof (such as a portion encoding at least 15 amino acid residues of a *Chlamydial* protein), expression vectors comprising such polynucleotides and host cells transformed or transfected with such expression vectors.

15 In a related aspect, polynucleotide sequences encoding the above polypeptides, recombinant expression vectors comprising one or more of these polynucleotide sequences and host cells transformed or transfected with such expression vectors are also provided.

20 In another aspect, the present invention provides fusion proteins comprising an inventive polypeptide, or, alternatively, an inventive polypeptide and a known *Chlamydia* antigen, as well as polynucleotides encoding such fusion proteins, in combination with a physiologically acceptable carrier or immunostimulant for use as pharmaceutical compositions and vaccines thereof.

25 The present invention further provides pharmaceutical compositions that comprise: (a) an antibody, both polyclonal and monoclonal, or antigen-binding fragment thereof that specifically binds to a *Chlamydial* protein; and (b) a physiologically acceptable carrier. Within other aspects, the present invention provides pharmaceutical compositions that comprise one or more *Chlamydia* polypeptides disclosed herein, or a polynucleotide molecule encoding such a polypeptide, and a physiologically acceptable carrier. The invention also provides vaccines for prophylactic and therapeutic purposes comprising one or more of the disclosed polypeptides and an immunostimulant, as defined herein, together with vaccines comprising one or more polynucleotide sequences encoding such polypeptides and an immunostimulant.

35 In yet another aspect, methods are provided for inducing protective immunity in a patient, comprising administering to a patient an effective amount of one or more of the above pharmaceutical compositions or vaccines.



In yet a further aspect, methods for the treatment of *Chlamydia* infection in a patient are provided, the methods comprising obtaining peripheral blood mononuclear cells (PBMC) from the patient, incubating the PBMC with a polypeptide of the present invention (or a polynucleotide that encodes such a polypeptide) to provide incubated T cells and administering the incubated T cells to the patient. The present invention additionally provides methods for the treatment of *Chlamydia* infection that comprise incubating antigen presenting cells with a polypeptide of the present invention (or a polynucleotide that encodes such a polypeptide) to provide incubated antigen presenting cells and administering the incubated antigen presenting cells to the patient. Proliferated cells may, but need not, be cloned prior to administration to the patient. In certain embodiments, the antigen presenting cells are selected from the group consisting of dendritic cells, macrophages, monocytes, B-cells, and fibroblasts. Compositions for the treatment of *Chlamydia* infection comprising T cells or antigen presenting cells that have been incubated with a polypeptide or polynucleotide of the present invention are also provided. Within related aspects, vaccines are provided that comprise: (a) an antigen presenting cell that expresses a polypeptide as described above and (b) an immunostimulant.

The present invention further provides, within other aspects, methods for removing *Chlamydial*-infected cells from a biological sample, comprising contacting a biological sample with T cells that specifically react with a *Chlamydial* protein, wherein the step of contacting is performed under conditions and for a time sufficient to permit the removal of cells expressing the protein from the sample.

Within related aspects, methods are provided for inhibiting the development of *Chlamydial* infection in a patient, comprising administering to a patient a biological sample treated as described above. In further aspects of the subject invention, methods and diagnostic kits are provided for detecting *Chlamydia* infection in a patient. In one embodiment, the method comprises: (a) contacting a biological sample with at least one of the polypeptides or fusion proteins disclosed herein; and (b) detecting in the sample the presence of binding agents that bind to the polypeptide or fusion protein, thereby detecting *Chlamydia* infection in the biological sample. Suitable biological samples include whole blood, sputum, serum, plasma, saliva, cerebrospinal fluid and urine. In one embodiment, the diagnostic kits comprise one or more of the polypeptides or fusion proteins disclosed herein in combination with a detection reagent. In yet another embodiment, the diagnostic kits comprise either a monoclonal antibody or a polyclonal antibody that binds with a polypeptide of the present invention.

The present invention also provides methods for detecting *Chlamydia* infection comprising: (a) obtaining a biological sample from a patient; (b) contacting the sample with at least two oligonucleotide primers in a polymerase chain reaction, at least one of the oligonucleotide primers being specific for a polynucleotide sequence disclosed herein; and (c) detecting in the sample a polynucleotide sequence that amplifies in the presence of the oligonucleotide primers. In one embodiment, the oligonucleotide primer comprises at least about 10 contiguous nucleotides of a polynucleotide sequence peptide disclosed herein, or of a sequence that hybridizes thereto.

10 In a further aspect, the present invention provides a method for detecting *Chlamydia* infection in a patient comprising: (a) obtaining a biological sample from the patient; (b) contacting the sample with an oligonucleotide probe specific for a polynucleotide sequence disclosed herein; and (c) detecting in the sample a polynucleotide sequence that hybridizes to the oligonucleotide probe. In one  
15 embodiment, the oligonucleotide probe comprises at least about 15 contiguous nucleotides of a polynucleotide sequence disclosed herein, or a sequence that hybridizes thereto.

These and other aspects of the present invention will become apparent upon reference to the following detailed description. All references disclosed herein are  
20 hereby incorporated by reference in their entirety as if each was incorporated individually.

#### SEQUENCE IDENTIFIERS

SEQ ID NO: 1 is the determined DNA sequence for the *C. trachomatis* clone 1-B1-66.

25 SEQ ID NO: 2 is the determined DNA sequence for the *C. trachomatis* clone 4-D7-28.

SEQ ID NO: 3 is the determined DNA sequence for the *C. trachomatis* clone 3-G3-10.

30 SEQ ID NO: 4 is the determined DNA sequence for the *C. trachomatis* clone 10-C10-31.

SEQ ID NO: 5 is the predicted amino acid sequence for 1-B1-66.

SEQ ID NO: 6 is the predicted amino acid sequence for 4-D7-28.

SEQ ID NO: 7 is a first predicted amino acid sequence for 3-G3-10.

SEQ ID NO: 8 is a second predicted amino acid sequence for 3-G3-10.

35 SEQ ID NO: 9 is a third predicted amino acid sequence for 3-G3-10.

- SEQ ID NO: 10 is a fourth predicted amino acid sequence for 3-G3-10.  
 SEQ ID NO: 11 is a fifth predicted amino acid sequence for 3-G3-10.  
 SEQ ID NO: 12 is the predicted amino acid sequence for 10-C10-31.  
 SEQ ID NO: 13 is the amino acid sequence of the synthetic peptide 1-  
 5 B1-66/48-67.  
 SEQ ID NO: 14 is the amino acid sequence of the synthetic peptide 1-  
 B1-66/58-77.  
 SEQ ID NO: 15 is the determined DNA sequence for the *C. trachomatis*  
 serovar LGV II clone 2C7-8  
 10 SEQ ID NO: 16 is a DNA sequence of a putative open reading frame  
 from a region of the *C. trachomatis* serovar D genome to which 2C7-8 maps  
 SEQ ID NO: 17 is the predicted amino acid sequence encoded by the  
 DNA sequence of SEQ ID NO: 16  
 SEQ ID NO: 18 is the amino acid sequence of the synthetic peptide  
 15 CtC7.8-12  
 SEQ ID NO: 19 is the amino acid sequence of the synthetic peptide  
 CtC7.8-13  
 SEQ ID NO: 20 is the predicted amino acid sequence encoded by a  
 second putative open reading from *C. trachomatis* serovar D  
 20 SEQ ID NO: 21 is the determined DNA sequence for clone 4C9-18 from  
*C. trachomatis* LGV II  
 SEQ ID NO: 22 is the determined DNA sequence homologous to  
 Lipoamide Dehydrogenase from *C. trachomatis* LGV II  
 SEQ ID NO: 23 is the determined DNA sequence homologous to  
 25 Hypothetical protein from *C. trachomatis* LGV II  
 SEQ ID NO: 24 is the determined DNA sequence homologous to  
 Ubiquinone Mehtyltransferase from *C. trachomatis* LGV II  
 SEQ ID NO: 25 is the determined DNA sequence for clone 4C9-18#2  
 BL21 pLysS from *C. trachomatis* LGV II  
 30 SEQ ID NO: 26 is the predicted amino acid sequence for 4C9-18#2 from  
*C. trachomatis* LGV II  
 SEQ ID NO: 27 is the determined DNA sequence for Cp-SWIB from *C.*  
*pneumonia* strain TWAR  
 SEQ ID NO: 28 is the predicted amino acid sequence for Cp-SWIB from  
 35 *C. pneumonia* strain TWAR

SEQ ID NO: 29 is the determined DNA sequence for Cp-S13 from *C. pneumonia* strain TWAR

SEQ ID NO: 30 is the predicted amino acid sequence for Cp-S13 from *C. pneumonia* strain TWAR

5 SEQ ID NO: 31 is the amino acid sequence for a 10mer consensus peptide from CtC7.8-12 and CtC7.8-13

SEQ ID NO: 32 is the predicted amino acid sequence for clone 2C7-8 from *C. trachomatis* LGV II

10 SEQ ID NO: 33 is the DNA sequence corresponding to nucleotides 597304-597145 of the *C. trachomatis* serovar D genome (NCBI, BLASTN search), which shows homology to clone 2C7-8

SEQ ID NO: 34 is the predicted amino acid sequence encoded by the sequence of SEQ ID NO: 33

15 SEQ ID NO: 35 is the DNA sequence for C.p. SWIB Nde (5' primer) from *C. pneumonia*

SEQ ID NO: 36 is the DNA sequence for C.p. SWIB EcoRI (3' primer) from *C. pneumonia*

SEQ ID NO : 37 is the DNA sequence for C.p. S13 Nde (5' primer) from *C. pneumonia*

20 SEQ ID NO: 38 is the DNA sequence for C.p. S13 EcoRI (3' primer) from *C. pneumonia*

SEQ ID NO: 39 is the amino acid sequence for CtSwib 52-67 peptide from *C. trachomatis* LGV II

25 SEQ ID NO: 40 is the amino acid sequence for CpSwib 53-68 peptide from *C. pneumonia*

SEQ ID NO: 41 is the amino acid sequence for HuSwib 288-302 peptide from Human SWI domain

SEQ ID NO: 42 is the amino acid sequence for CtSWI-T 822-837 peptide from the topoisomerase-SWIB fusion of *C. trachomatis*

30 SEQ ID NO: 43 is the amino acid sequence for CpSWI-T 828-842 peptide from the topoisomerase-SWIB fusion of *C. pneumonia*

SEQ ID NO: 44 is a first determined DNA sequence for the *C. trachomatis* LGV II clone 19783.3.jen.seq(1>509)CTL2#11-3', representing the 3' end.

35 SEQ ID NO: 45 is a second determined DNA sequence for the *C. trachomatis* LGV II clone 19783.4.jen.seq(1>481)CTL2#11-5', representing the 5' end.

SEQ ID NO: 46 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19784CTL2\_12consensus.seq(1>427)CTL2#12.

SEQ ID NO: 47 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19785.4.jen.seq(1>600)CTL2#16-5', representing the 5' end.

5 SEQ ID NO: 48 is a first determined DNA sequence for the *C. trachomatis* LGV II clone 19786.3.jen.seq(1>600)CTL2#18-3', representing the 3' end.

SEQ ID NO: 49 is a second determined DNA sequence for the *C. trachomatis* LGV II clone 19786.4.jen.seq(1>600)CTL2#18-5', representing the 5' end.

10 SEQ ID NO: 50 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19788CTL2\_21consensus.seq(1>406)CTL2#21.

SEQ ID NO: 51 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19790CTL2\_23consensus.seq(1>602)CTL2#23.

SEQ ID NO: 52 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19791CTL2\_24consensus.seq(1>145)CTL2#24.

15 SEQ ID NO: 53 is the determined DNA sequence for the *C. trachomatis* LGV II clone CTL2#4.

SEQ ID NO: 54 is the determined DNA sequence for the *C. trachomatis* LGV II clone CTL2#8b.

20 SEQ ID NO: 55 is the determined DNA sequence for the *C. trachomatis* LGV II clone 15-G1-89, sharing homology to the lipoamide dehydrogenase gene CT557.

SEQ ID NO: 56 is the determined DNA sequence for the *C. trachomatis* LGV II clone 14-H1-4, sharing homology to the thiol specific antioxidant gene CT603.

25 SEQ ID NO: 57 is the determined DNA sequence for the *C. trachomatis* LGV II clone 12-G3-83, sharing homology to the hypothetical protein CT622.

SEQ ID NO: 58 is the determined DNA sequence for the *C. trachomatis* LGV II clone 12-B3-95, sharing homology to the lipoamide dehydrogenase gene CT557.

30 SEQ ID NO: 59 is the determined DNA sequence for the *C. trachomatis* LGV II clone 11-H4-28, sharing homology to the dnaK gene CT396.

SEQ ID NO: 60 is the determined DNA sequence for the *C. trachomatis* LGV II clone 11-H3-68, sharing partial homology to the PGP6-D virulence protein and L1 ribosomal gene CT318.

35 SEQ ID NO: 61 is the determined DNA sequence for the *C. trachomatis* LGV II clone 11-G1-34, sharing partial homology to the malate dehydrogenase gene CT376 and to the glycogen hydrolase gene CT042.

SEQ ID NO: 62 is the determined DNA sequence for the *C. trachomatis* LGV II clone 11-G10-46, sharing homology to the hypothetical protein CT610.

SEQ ID NO: 63 is the determined DNA sequence for the *C. trachomatis* LGV II clone 11-C12-91, sharing homology to the OMP2 gene CT443.

5 SEQ ID NO: 64 is the determined DNA sequence for the *C. trachomatis* LGV II clone 11-A3-93, sharing homology to the HAD superfamily gene CT103.

SEQ ID NO: 65 is the determined amino acid sequence for the *C. trachomatis* LGV II clone 14-H1-4, sharing homology to the thiol specific antioxidant gene CT603.

10 SEQ ID NO: 66 is the determined DNA sequence for the *C. trachomatis* LGV II clone CtL2#9.

SEQ ID NO: 67 is the determined DNA sequence for the *C. trachomatis* LGV II clone CtL2#7.

15 SEQ ID NO: 68 is the determined DNA sequence for the *C. trachomatis* LGV II clone CtL2#6.

SEQ ID NO: 69 is the determined DNA sequence for the *C. trachomatis* LGV II clone CtL2#5.

SEQ ID NO: 70 is the determined DNA sequence for the *C. trachomatis* LGV II clone CtL2#2.

20 SEQ ID NO: 71 is the determined DNA sequence for the *C. trachomatis* LGV II clone CtL2#1.

SEQ ID NO: 72 is a first determined DNA sequence for the *C. trachomatis* LGV II clone 23509.2CtL2#3-5', representing the 5' end.

25 SEQ ID NO: 73 is a second determined DNA sequence for the *C. trachomatis* LGV II clone 23509.1CtL2#3-3', representing the 3' end.

SEQ ID NO: 74 is a first determined DNA sequence for the *C. trachomatis* LGV II clone 22121.2CtL2#10-5', representing the 5' end.

SEQ ID NO: 75 is a second determined DNA sequence for the *C. trachomatis* LGV II clone 22121.1CtL2#10-3', representing the 3' end.

30 SEQ ID NO: 76 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19787.6CtL2#19-5', representing the 5' end.

SEQ ID NO: 77 is the determined DNA sequence for the *C. pneumoniae* LGV II clone CpS13-His.

35 SEQ ID NO: 78 is the determined DNA sequence for the *C. pneumoniae* LGV II clone Cp\_SWIB-His.

SEQ ID NO: 79 is the determined DNA sequence for the *C. trachomatis* LGV II clone 23-G7-68, sharing partial homology to the L11, L10 and L1 ribosomal protein.

5 SEQ ID NO: 80 is the determined DNA sequence for the *C. trachomatis* LGV II clone 22-F8-91, sharing homology to the pmpC gene.

SEQ ID NO: 81 is the determined DNA sequence for the *C. trachomatis* LGV II clone 21-E8-95, sharing homology to the CT610-CT613 genes.

SEQ ID NO: 82 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19-F12-57, sharing homology to the CT858 and recA genes.

10 SEQ ID NO: 83 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19-F12-53, sharing homology to the CT445 gene encoding glutamyl tRNA synthetase.

SEQ ID NO: 84 is the determined DNA sequence for the *C. trachomatis* LGV II clone 19-A5-54, sharing homology to the cryptic plasmid gene.

15 SEQ ID NO: 85 is the determined DNA sequence for the *C. trachomatis* LGV II clone 17-E11-72, sharing partial homology to the OppC\_2 and pmpD genes.

SEQ ID NO: 86 is the determined DNA sequence for the *C. trachomatis* LGV II clone 17-C1-77, sharing partial homology to the CT857 and CT858 open reading frames.

20 SEQ ID NO: 87 is the determined DNA sequence for the *C. trachomatis* LGV II clone 15-H2-76, sharing partial homology to the pmpD and SycE genes, and to the CT089 ORF.

SEQ ID NO: 88 is the determined DNA sequence for the *C. trachomatis* LGV II clone 15-A3-26, sharing homology to the CT858 ORF.

25 SEQ ID NO: 89 is the determined amino acid sequence for the *C. pneumoniae* clone Cp\_SWIB-His.

SEQ ID NO: 90 is the determined amino acid sequence for the *C. trachomatis* LGV II clone CtL2\_LPDA\_FL.

30 SEQ ID NO: 91 is the determined amino acid sequence for the *C. pneumoniae* clone CpS13-His.

SEQ ID NO: 92 is the determined amino acid sequence for the *C. trachomatis* LGV II clone CtL2\_TSA\_FL.

SEQ ID NO: 93 is the amino acid sequence for Ct-Swib 43-61 peptide from *C. trachomatis* LGV II.

35 SEQ ID NO: 94 is the amino acid sequence for Ct-Swib 48-67 peptide from *C. trachomatis* LGV II.

SEQ ID NO: 95 is the amino acid sequence for Ct-Swib 52-71 peptide from *C. trachomatis* LGV II.

SEQ ID NO: 96 is the amino acid sequence for Ct-Swib 58-77 peptide from *C. trachomatis* LGV II.

5           SEQ ID NO: 97 is the amino acid sequence for Ct-Swib 63-82 peptide from *C. trachomatis* LGV II.

SEQ ID NO: 98 is the amino acid sequence for Ct-Swib 51-66 peptide from *C. trachomatis* LGV II.

10           SEQ ID NO: 99 is the amino acid sequence for Cp-Swib 52-67 peptide from *C. pneumonia*.

SEQ ID NO: 100 is the amino acid sequence for Cp-Swib 37-51 peptide from *C. pneumonia*.

SEQ ID NO: 101 is the amino acid sequence for Cp-Swib 32-51 peptide from *C. pneumonia*.

15           SEQ ID NO: 102 is the amino acid sequence for Cp-Swib 37-56 peptide from *C. pneumonia*.

SEQ ID NO: 103 is the amino acid sequence for Ct-Swib 36-50 peptide from *C. trachomatis*.

20           SEQ ID NO: 104 is the amino acid sequence for Ct-S13 46-65 peptide from *C. trachomatis*.

SEQ ID NO: 105 is the amino acid sequence for Ct-S13 60-80 peptide from *C. trachomatis*.

SEQ ID NO: 106 is the amino acid sequence for Ct-S13 1-20 peptide from *C. trachomatis*.

25           SEQ ID NO: 107 is the amino acid sequence for Ct-S13 46-65 peptide from *C. trachomatis*.

SEQ ID NO: 108 is the amino acid sequence for Ct-S13 56-75 peptide from *C. trachomatis*.

30           SEQ ID NO: 109 is the amino acid sequence for Cp-S13 56-75 peptide from *C. pneumoniae*.

SEQ ID NO: 110 is the determined DNA sequence for the *C. trachomatis* LGV II clone 21-G12-60, containing partial open reading frames for hypothetical proteins CT875, CT229 and CT228.

35           SEQ ID NO: 111 is the determined DNA sequence for the *C. trachomatis* LGV II clone 22-B3-53, sharing homology to the CT110 ORF of GroEL.



SEQ ID NO: 112 is the determined DNA sequence for the *C. trachomatis* LGV II clone 22-A1-49, sharing partial homology to the CT660 and CT659 ORFs.

5 SEQ ID NO: 113 is the determined DNA sequence for the *C. trachomatis* LGV II clone 17-E2-9, sharing partial homology to the CT611 and CT 610 ORFs.

SEQ ID NO: 114 is the determined DNA sequence for the *C. trachomatis* LGV II clone 17-C10-31, sharing partial homology to the CT858 ORF.

10 SEQ ID NO: 115 is the determined DNA sequence for the *C. trachomatis* LGV II clone 21-C7-66, sharing homology to the dnaK-like gene.

SEQ ID NO: 116 is the determined DNA sequence for the *C. trachomatis* LGV II clone 20-G3-45, containing part of the pmpB gene CT413.

SEQ ID NO: 117 is the determined DNA sequence for the *C. trachomatis* LGV II clone 18-C5-2, sharing homology to the S1 ribosomal protein ORF.

15 SEQ ID NO: 118 is the determined DNA sequence for the *C. trachomatis* LGV II clone 17-C5-19, containing part of the ORFs for CT431 and CT430.

20 SEQ ID NO: 119 is the determined DNA sequence for the *C. trachomatis* LGV II clone 16-D4-22, contains partial sequences of ORF3 and ORF4 of the plasmid for growth within mammalian cells.

SEQ ID NO: 120 is the determined full-length DNA sequence for the *C. trachomatis* serovar LGV II Cap1 gene CT529.

SEQ ID NO: 121 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar LGV II Cap1 gene CT529.

25 SEQ ID NO: 122 is the determined full-length DNA sequence for the *C. trachomatis* serovar E Cap1 gene CT529.

SEQ ID NO: 123 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar E Cap1 gene CT529.

30 SEQ ID NO: 124 is the determined full-length DNA sequence for the *C. trachomatis* serovar 1A Cap1 gene CT529.

SEQ ID NO: 125 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar 1A Cap1 gene CT529.

SEQ ID NO: 126 is the determined full-length DNA sequence for the *C. trachomatis* serovar G Cap1 gene CT529.

35 SEQ ID NO: 127 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar G Cap1 gene CT529.

- SEQ ID NO: 128 is the determined full-length DNA sequence for the *C. trachomatis* serovar F1 NII Cap1 gene CT529.
- SEQ ID NO: 129 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar F1 NII Cap1 gene CT529.
- 5 SEQ ID NO: 130 is the determined full-length DNA sequence for the *C. trachomatis* serovar L1 Cap1 gene CT529.
- SEQ ID NO: 131 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar L1 Cap1 gene CT529.
- 10 SEQ ID NO: 132 is the determined full-length DNA sequence for the *C. trachomatis* serovar L3 Cap1 gene CT529.
- SEQ ID NO: 133 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar L3 Cap1 gene CT529.
- SEQ ID NO: 134 is the determined full-length DNA sequence for the *C. trachomatis* serovar Ba Cap1 gene CT529.
- 15 SEQ ID NO: 135 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar Ba Cap1 gene CT529.
- SEQ ID NO: 136 is the determined full-length DNA sequence for the *C. trachomatis* serovar MOPN Cap1 gene CT529.
- 20 SEQ ID NO: 137 is the predicted full-length amino acid sequence for the *C. trachomatis* serovar MOPN Cap1 gene CT529.
- SEQ ID NO: 138 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #124-139 of *C. trachomatis* serovar L2.
- SEQ ID NO: 139 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #132-147 of *C. trachomatis* serovar L2.
- 25 SEQ ID NO: 140 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #138-155 of *C. trachomatis* serovar L2.
- SEQ ID NO: 141 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #146-163 of *C. trachomatis* serovar L2.
- SEQ ID NO: 142 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #154-171 of *C. trachomatis* serovar L2.
- 30 SEQ ID NO: 143 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #162-178 of *C. trachomatis* serovar L2.
- SEQ ID NO: 144 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #138-147 of *C. trachomatis* serovar L2.
- 35 SEQ ID NO: 145 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #139-147 of *C. trachomatis* serovar L2.

SEQ ID NO: 146 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #140-147 of *C. trachomatis* serovar L2.

SEQ ID NO: 147 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #138-146 of *C. trachomatis* serovar L2.

5 SEQ ID NO: 148 is the determined amino acid sequence for the Cap1 CT529 ORF peptide #138-145 of *C. trachomatis* serovar L2.

SEQ ID NO: 149 is the determined amino acid sequence for the Cap1 CT529 ORF peptide # F140->I of *C. trachomatis* serovar L2.

10 SEQ ID NO: 150 is the determined amino acid sequence for the Cap1 CT529 ORF peptide # #S139>Ga of *C. trachomatis* serovar L2.

SEQ ID NO: 151 is the determined amino acid sequence for the Cap1 CT529 ORF peptide # #S139>Gb of *C. trachomatis* serovar L2.

SEQ ID NO: 152 is the determined amino acid sequence for the peptide # 2 C7.8-6 of the 216aa ORF of *C. trachomatis* serovar L2.

15 SEQ ID NO: 153 is the determined amino acid sequence for the peptide # 2 C7.8-7 of the 216aa ORF of *C. trachomatis* serovar L2.

SEQ ID NO: 154 is the determined amino acid sequence for the peptide # 2 C7.8-8 of the 216aa ORF of *C. trachomatis* serovar L2.

20 # 2 C7.8-9 of the 216aa ORF of *C. trachomatis* serovar L2.

SEQ ID NO: 156 is the determined amino acid sequence for the peptide # 2 C7.8-10 of the 216aa ORF of *C. trachomatis* serovar L2.

25 SEQ ID NO: 157 is the determined amino acid sequence for the 53 amino acid residue peptide of the 216aa ORF within clone 2C7.8 of *C. trachomatis* serovar L2.

SEQ ID NO: 158 is the determined amino acid sequence for the 52 amino acid residue peptide of the CT529 ORF within clone 2C7.8 of *C. trachomatis* serovar L2.

30 SEQ ID NO: 159 is the determined DNA sequence for the 5' (forward) primer for cloning full-length CT529 serovar L2.

SEQ ID NO: 160 is the determined DNA sequence for the 5' (reverse) primer for cloning full-length CT529 serovar L2.

SEQ ID NO: 161 is the determined DNA sequence for the 5' (forward) primer for cloning full-length CT529 for serovars other than L2 and MOPN.

35 SEQ ID NO: 162 is the determined DNA sequence for the 5' (reverse) primer for cloning full-length CT529 serovars other than L2 and MOPN.

SEQ ID NO: 163 is the determined DNA sequence for the 5' (forward) primer for cloning full-length CT529 serovar MOPN.

SEQ ID NO: 164 is the determined DNA sequence for the 5' (reverse) primer for cloning full-length CT529 serovar MOPN.

5           SEQ ID NO: 165 is the determined DNA sequence for the 5' (forward) primer for pBIB-KS.

SEQ ID NO: 166 is the determined DNA sequence for the 5' (reverse) primer for pBIB-KS.

10           SEQ ID NO: 167 is the determined amino acid sequence for the 9-mer epitope peptide Cap1#139-147 from serovar L2.

SEQ ID NO: 168 is the determined amino acid sequence for the 9-mer epitope peptide Cap1#139-147 from serovar D.

SEQ ID NO: 169 is the determined full-length DNA sequence for the *C. trachomatis* pmpI gene.

15           SEQ ID NO: 170 is the determined full-length DNA sequence for the *C. trachomatis* pmpG gene.

SEQ ID NO: 171 is the determined full-length DNA sequence for the *C. trachomatis* pmpE gene.

20           SEQ ID NO: 172 is the determined full-length DNA sequence for the *C. trachomatis* pmpD gene.

SEQ ID NO: 173 is the determined full-length DNA sequence for the *C. trachomatis* pmpC gene.

SEQ ID NO: 174 is the determined full-length DNA sequence for the *C. trachomatis* pmpB gene.

25           SEQ ID NO: 175 is the predicted full-length amino acid sequence for the *C. trachomatis* pmpI gene.

SEQ ID NO: 176 is the predicted full-length amino acid sequence for the *C. trachomatis* pmpG gene.

30           SEQ ID NO: 177 is the predicted full-length amino acid sequence for the *C. trachomatis* pmpE gene.

SEQ ID NO: 178 is the predicted full-length amino acid sequence for the *C. trachomatis* pmpD gene.

SEQ ID NO: 179 is the predicted full-length amino acid sequence for the *C. trachomatis* pmpC gene.

35           SEQ ID NO: 180 is the predicted full-length amino acid sequence for the *C. trachomatis* pmpB gene.

SEQ ID NO: 181 is the determined DNA sequence minus the signal sequence for the *C. trachomatis* pmpI gene.

SEQ ID NO: 182 is a subsequently determined full-length DNA sequence for the *C. trachomatis* pmpG gene.

5 SEQ ID NO: 183 is the determined DNA sequence minus the signal sequence for the *C. trachomatis* pmpE gene.

SEQ ID NO: 184 is a first determined DNA sequence representing the carboxy terminus for the *C. trachomatis* pmpD gene.

10 SEQ ID NO: 185 is a second determined DNA sequence representing the amino terminus minus the signal sequence for the *C. trachomatis* pmpD gene.

SEQ ID NO: 186 is a first determined DNA sequence representing the carboxy terminus for the *C. trachomatis* pmpC gene.

SEQ ID NO: 187 is a second determined DNA sequence representing the amino terminus minus the signal sequence for the *C. trachomatis* pmpC gene.

15 SEQ ID NO: 188 is the determined DNA sequence representing the *C. pneumoniae* serovar MOMPS pmp gene in a fusion molecule with Ra12.

SEQ ID NO: 189 is the predicted amino acid sequence minus the signal sequence for the *C. trachomatis* pmpI gene.

20 SEQ ID NO: 190 is subsequently predicted amino acid sequence for the *C. trachomatis* pmpG gene.

SEQ ID NO: 191 is the predicted amino acid sequence minus the signal sequence for the *C. trachomatis* pmpE gene.

SEQ ID NO: 192 is a first predicted amino acid sequence representing the carboxy terminus for the *C. trachomatis* pmpD gene.

25 SEQ ID NO: 193 is a second predicted amino acid sequence representing the Amino terminus minus the signal sequence for the *C. trachomatis* pmpD gene.

SEQ ID NO: 194 is a first predicted amino acid sequence representing the Carboxy terminus for the *C. trachomatis* pmpC gene.

30 SEQ ID NO: 195 is a second predicted amino acid sequence representing the Amino terminus for the *C. trachomatis* pmpC gene.

SEQ ID NO: 196 is the predicted amino acid sequence representing the *C. pneumoniae* serovar MOMPS pmp gene in a fusion molecule with Ra12.

SEQ ID NO: 197 is the determined DNA sequence for the 5' oligo primer for cloning the *C. trachomatis* pmpC gene in the SKB vaccine vector.

35 SEQ ID NO: 198 is the determined DNA sequence for the 3' oligo primer for cloning the *C. trachomatis* pmpC gene in the SKB vaccine vector.

SEQ ID NO: 199 is the determined DNA sequence for the insertion sequence for cloning the *C. trachomatis* pmpC gene in the SKB vaccine vector.

SEQ ID NO: 200 is the determined DNA sequence for the 5' oligo primer for cloning the *C. trachomatis* pmpD gene in the SKB vaccine vector.

5           SEQ ID NO: 201 is the determined DNA sequence for the 3' oligo primer for cloning the *C. trachomatis* pmpD gene in the SKB vaccine vector.

SEQ ID NO: 202 is the determined DNA sequence for the insertion sequence for cloning the *C. trachomatis* pmpD gene in the SKB vaccine vector.

10           SEQ ID NO: 203 is the determined DNA sequence for the 5' oligo primer for cloning the *C. trachomatis* pmpE gene in the SKB vaccine vector.

SEQ ID NO: 204 is the determined DNA sequence for the 3' oligo primer for cloning the *C. trachomatis* pmpE gene in the SKB vaccine vector.

SEQ ID NO: 205 is the determined DNA sequence for the 5' oligo primer for cloning the *C. trachomatis* pmpG gene in the SKB vaccine vector.

15           SEQ ID NO: 206 is the determined DNA sequence for the 3' oligo primer for cloning the *C. trachomatis* pmpG gene in the SKB vaccine vector.

SEQ ID NO: 207 is the determined DNA sequence for the 5' oligo primer for cloning the amino terminus portion of the *C. trachomatis* pmpC gene in the pET17b vector.

20           SEQ ID NO: 208 is the determined DNA sequence for the 3' oligo primer for cloning the amino terminus portion of the *C. trachomatis* pmpC gene in the pET17b vector.

25           SEQ ID NO: 209 is the determined DNA sequence for the 5' oligo primer for cloning the carboxy terminus portion of the *C. trachomatis* pmpC gene in the pET17b vector.

SEQ ID NO: 210 is the determined DNA sequence for the 3' oligo primer for cloning the carboxy terminus portion of the *C. trachomatis* pmpC gene in the pET17b vector.

30           SEQ ID NO: 211 is the determined DNA sequence for the 5' oligo primer for cloning the amino terminus portion of the *C. trachomatis* pmpD gene in the pET17b vector.

SEQ ID NO: 212 is the determined DNA sequence for the 3' oligo primer for cloning the amino terminus portion of the *C. trachomatis* pmpD gene in the pET17b vector.

SEQ ID NO: 213 is the determined DNA sequence for the 5' oligo primer for cloning the carboxy terminus portion of the *C. trachomatis* pmpD gene in the pET17b vector.

5 SEQ ID NO: 214 is the determined DNA sequence for the 3' oligo primer for cloning the carboxy terminus portion of the *C. trachomatis* pmpD gene in the pET17b vector.

SEQ ID NO: 215 is the determined DNA sequence for the 5' oligo primer for cloning the *C. trachomatis* pmpE gene in the pET17b vector.

10 SEQ ID NO: 216 is the determined DNA sequence for the 3' oligo primer for cloning the *C. trachomatis* pmpE gene in the pET17b vector.

SEQ ID NO: 217 is the determined DNA sequence for the insertion sequence for cloning the *C. trachomatis* pmpE gene in the pET17b vector.

15 SEQ ID NO: 218 is the amino acid sequence for the insertion sequence for cloning the *C. trachomatis* pmpE gene in the pET17b vector.

SEQ ID NO: 219 is the determined DNA sequence for the 5' oligo primer for cloning the *C. trachomatis* pmpG gene in the pET17b vector.

SEQ ID NO: 220 is the determined DNA sequence for the 3' oligo primer for cloning the *C. trachomatis* pmpG gene in the pET17b vector.

20 SEQ ID NO: 221 is the amino acid sequence for the insertion sequence for cloning the *C. trachomatis* pmpG gene in the pET17b vector.

SEQ ID NO: 222 is the determined DNA sequence for the 5' oligo primer for cloning the *C. trachomatis* pmpI gene in the pET17b vector.

SEQ ID NO: 223 is the determined DNA sequence for the 3' oligo primer for cloning the *C. trachomatis* pmpI gene in the pET17b vector.

25 SEQ ID NO: 224 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 1-20.

SEQ ID NO: 225 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 6-25.

30 SEQ ID NO: 226 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 12-31.

SEQ ID NO: 227 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 17-36.

SEQ ID NO: 228 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 22-41.

35 SEQ ID NO: 229 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 27-46.

SEQ ID NO: 230 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 42-61.

SEQ ID NO: 231 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 46-65.

5           SEQ ID NO: 232 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 51-70.

SEQ ID NO: 233 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 56-75.

10           SEQ ID NO: 234 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 61-80.

SEQ ID NO: 235 is the determined amino acid sequence for the *C. pneumoniae* Swib peptide 66-87.

SEQ ID NO: 236 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 103-122.

15           SEQ ID NO: 237 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 108-127.

SEQ ID NO: 238 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 113-132.

20           SEQ ID NO: 239 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 118-137.

SEQ ID NO: 240 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 123-143.

SEQ ID NO: 241 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 128-147.

25           SEQ ID NO: 242 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 133-152.

SEQ ID NO: 243 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 137-156.

30           SEQ ID NO: 244 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 142-161.

SEQ ID NO: 245 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 147-166.

SEQ ID NO: 246 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 152-171.

35           SEQ ID NO: 247 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 157-176.



SEQ ID NO: 248 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 162-181.

SEQ ID NO: 249 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 167-186.

5           SEQ ID NO: 250 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 171-190.

SEQ ID NO: 251 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 171-186.

10           SEQ ID NO: 252 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 175-186.

SEQ ID NO: 252 is the determined amino acid sequence for the *C. trachomatis* OMCB peptide 175-186.

SEQ ID NO: 253 is the determined amino acid sequence for the *C. pneumoniae* OMCB peptide 185-198.

15           SEQ ID NO: 254 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 96-115.

SEQ ID NO: 255 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 101-120.

20           SEQ ID NO: 256 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 106-125.

SEQ ID NO: 257 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 111-130.

SEQ ID NO: 258 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 116-135.

25           SEQ ID NO: 259 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 121-140.

SEQ ID NO: 260 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 126-145.

30           SEQ ID NO: 261 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 131-150.

SEQ ID NO: 262 is the determined amino acid sequence for the *C. trachomatis* TSA peptide 136-155.

SEQ ID NO: 263 is the determined full-length DNA sequence for the *C. trachomatis* CT529/Cap 1 gene serovar I.

35           SEQ ID NO: 264 is the predicted full-length amino sequence for the *C. trachomatis* CT529/Cap 1 gene serovar I.

SEQ ID NO: 265 is the determined full-length DNA sequence for the *C. trachomatis* CT529/Cap 1 gene serovar K.

SEQ ID NO: 266 is the predicted full-length amino sequence for the *C. trachomatis* CT529/Cap 1 gene serovar K.

- 5               SEQ ID NO: 267 is the determined DNA sequence for the *C. trachomatis* clone 17-G4-36 sharing homology to part of the ORF of DNA-dirrected RNA polymerase beta subunit- CT315 in serD.

SEQ ID NO: 268 is the determined DNA sequence for the partial sequence of the *C. trachomatis* CT016 gene in clone 2E10.

- 10             SEQ ID NO: 269 is the determined DNA sequence for the partial sequence of the *C. trachomatis* tRNA syntase gene in clone 2E10.

SEQ ID NO: 270 is the determined DNA sequence for the partial sequence for the *C. trachomatis* clpX gene in clone 2E10.

- 15             SEQ ID NO: 271 is a first determined DNA sequence for the *C. trachomatis* clone CtL2gam-30 representing the 5'end.

SEQ ID NO: 272 is a second determined DNA sequence for the *C. trachomatis* clone CtL2gam-30 representing the 3'end.

SEQ ID NO: 273 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-28.

- 20             SEQ ID NO: 274 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-27.

SEQ ID NO: 275 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-26.

- 25             SEQ ID NO: 276 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-24.

SEQ ID NO: 277 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-23.

SEQ ID NO: 278 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-21.

- 30             SEQ ID NO: 279 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-18.

SEQ ID NO: 280 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-17.

- 35             SEQ ID NO: 281 is a first determined DNA sequence for the *C. trachomatis* clone CtL2gam-15 representing the 5' end.

SEQ ID NO: 282 is a second determined DNA sequence for the *C. trachomatis* clone CtL2gam-15 representing the 3' end.

SEQ ID NO: 283 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-13.

5           SEQ ID NO: 284 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-10.

SEQ ID NO: 285 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-8.

10           SEQ ID NO: 286 is a first determined DNA sequence for the *C. trachomatis* clone CtL2gam-6 representing the 5' end.

SEQ ID NO: 287 is a second determined DNA sequence for the *C. trachomatis* clone CtL2gam-6 representing the 3' end.

SEQ ID NO: 288 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-5.

15           SEQ ID NO: 289 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-2.

SEQ ID NO: 290 is the determined DNA sequence for the *C. trachomatis* clone CtL2gam-1.

20           SEQ ID NO: 291 is the determined full-length DNA sequence for the *C. pneumoniae* homologue of the CT529 gene.

SEQ ID NO: 292 is the predicted full-length amino acid sequence for the *C. pneumoniae* homologue of the CT529 gene.

SEQ ID NO: 293 is the determined DNA sequence for the insertion sequence for cloning the *C. trachomatis* pmpG gene in the SKB vaccine vector.

25           SEQ ID NO: 294 is the amino acid sequence of an open reading frame of clone CT603.

SEQ ID NO: 295 is the amino acid sequence of a first open reading frame of clone CT875.

30           SEQ ID NO: 296 is the amino acid sequence of a second open reading frame of clone CT875.

SEQ ID NO: 297 is the amino acid sequence of a first open reading frame of clone CT858.

SEQ ID NO: 298 is the amino acid sequence of a second open reading frame of clone CT858.

35           SEQ ID NO: 299 is the amino acid sequence of an open reading frame of clone CT622.

SEQ ID NO: 300 is the amino acid sequence of an open reading frame of clone CT610.

SEQ ID NO: 301 is the amino acid sequence of an open reading frame of clone CT396.

5           SEQ ID NO: 302 is the amino acid sequence of an open reading frame of clone CT318.

SEQ ID NO: 304 is the amino acid sequence for *C. trachomatis*, serovar L2 rCt529c1-125 having a modified N-terminal sequence (6-His tag).

10           SEQ ID NO: 305 is the amino acid sequence for *C. trachomatis*, serovar L2 rCt529c1-125.

SEQ ID NO: 306 is the sense primer used in the synthesis of the PmpA(N-term) fusion protein.

SEQ ID NO: 307 is the antisense primer used in the synthesis of the PmpA(N-term) fusion protein.

15           SEQ ID NO: 308 is the DNA sequence encoding the PmpA(N-term) fusion protein.

SEQ ID NO: 309 is the amino acid sequence of the PmpA(N-term) fusion protein.

20           SEQ ID NO: 310 is the sense primer used in the synthesis of the PmpA(C-term) fusion protein.

SEQ ID NO: 311 is the antisense primer used in the synthesis of the PmpA(C-term) fusion protein.

SEQ ID NO: 312 is the DNA sequence encoding the PmpA(C-term) fusion protein.

25           SEQ ID NO: 313 is the amino acid sequence of the PmpA(C-term) fusion protein.

SEQ ID NO: 314 is the sense primer used in the synthesis of the PmpF(N-term) fusion protein.

30           SEQ ID NO: 315 is the antisense primer used in the synthesis of the PmpF(N-term) fusion protein.

SEQ ID NO: 316 is the DNA sequence encoding the PmpF(N-term) fusion protein.

SEQ ID NO: 317 is the amino acid sequence of the PmpF(N-term) fusion protein.

35           SEQ ID NO: 318 is the sense primer used in the synthesis of the PmpF(C-term) fusion protein.

SEQ ID NO: 319 is the antisense primer used in the synthesis of the PmpF(C-term) fusion protein.

SEQ ID NO: 320 is the DNA sequence encoding the PmpF(C-term) fusion protein.

5 SEQ ID NO: 321 is the amino acid sequence of the PmpF(C-term) fusion protein.

SEQ ID NO: 322 is the sense primer used in the synthesis of the PmpH(N-term) fusion protein.

10 SEQ ID NO: 323 is the antisense primer used in the synthesis of the PmpH(N-term) fusion protein.

SEQ ID NO: 324 is the DNA sequence encoding the PmpH(N-term) fusion protein.

SEQ ID NO: 325 is the amino acid sequence of the PmpH(N-term) fusion protein.

15 SEQ ID NO: 326 is the sense primer used in the synthesis of the PmpH(C-term) fusion protein.

SEQ ID NO: 327 is the antisense primer used in the synthesis of the PmpH(C-term) fusion protein.

20 SEQ ID NO: 328 is the DNA sequence encoding the PmpH(C-term) fusion protein.

SEQ ID NO: 329 is the amino acid sequence of the PmpH(C-term) fusion protein.

SEQ ID NO: 330 is the sense primer used in the synthesis of the PmpB(1) fusion protein.

25 SEQ ID NO: 331 is the antisense primer used in the synthesis of the PmpB(1) fusion protein.

SEQ ID NO: 332 is the DNA sequence encoding the PmpB(1) fusion protein.

30 SEQ ID NO: 333 is the amino acid sequence of the PmpB(1) fusion protein.

SEQ ID NO: 334 is the sense primer used in the synthesis of the PmpB(2) fusion protein.

SEQ ID NO: 335 is the antisense primer used in the synthesis of the PmpB(2) fusion protein.

35 SEQ ID NO: 336 is the DNA sequence encoding the PmpB(2) fusion protein.

SEQ ID NO: 337 is the amino acid sequence of the PmpB(2) fusion protein.

SEQ ID NO: 338 is the sense primer used in the synthesis of the PmpB(3) fusion protein.

5 SEQ ID NO: 339 is the antisense primer used in the synthesis of the PmpB(3) fusion protein.

SEQ ID NO: 340 is the DNA sequence encoding the PmpB(3) fusion protein.

10 SEQ ID NO: 341 is the amino acid sequence of the PmpB(3) fusion protein.

SEQ ID NO: 342 is the sense primer used in the synthesis of the PmpB(4) fusion protein.

SEQ ID NO: 343 is the antisense primer used in the synthesis of the PmpB(4) fusion protein.

15 SEQ ID NO: 344 is the DNA sequence encoding the PmpB(4) fusion protein.

SEQ ID NO: 345 is the amino acid sequence of the PmpB(4) fusion protein.

20 SEQ ID NO: 346 is the sense primer used in the synthesis of the PmpC(1) fusion protein.

SEQ ID NO: 347 is the antisense primer used in the synthesis of the PmpC(1) fusion protein.

SEQ ID NO: 348 is the DNA sequence encoding the PmpC(1) fusion protein.

25 SEQ ID NO: 349 is the amino acid sequence of the PmpC(1) fusion protein.

SEQ ID NO: 350 is the sense primer used in the synthesis of the PmpC(2) fusion protein.

30 SEQ ID NO: 351 is the antisense primer used in the synthesis of the PmpC(2) fusion protein.

SEQ ID NO: 352 is the DNA sequence encoding the PmpC(2) fusion protein.

SEQ ID NO: 353 is the amino acid sequence of the PmpC(2) fusion protein.

35 SEQ ID NO: 354 is the sense primer used in the synthesis of the PmpC(3) fusion protein.

SEQ ID NO: 355 is the antisense primer used in the synthesis of the PmpC(3) fusion protein.

SEQ ID NO: 356 is the DNA sequence encoding the PmpC(3) fusion protein.

5 SEQ ID NO: 357 is the amino acid sequence of the PmpC(3) fusion protein.

#### DESCRIPTION OF THE FIGURES

Fig. 1 illustrates induction of INF- $\gamma$  from a *Chlamydia*-specific T cell line activated by target cells expressing clone 4C9-18#2.

10 Fig. 2 illustrates retroviral vectors pBIB-KS1,2,3 modified to contain a Kosak translation initiation site and stop codons.

Fig. 3 shows specific lysis in a chromium release assay of P815 cells pulsed with *Chlamydia* peptides CtC7.8-12 (SEQ ID NO: 18) and CtC7.8-13 (SEQ ID NO: 19).

15 Fig. 4 shows antibody isotype titers in C57Bl/6 mice immunized with *C. trachomatis* SWIB protein.

Fig. 5 shows *Chlamydia*-specific T-cell proliferative responses in splenocytes from C3H mice immunized with *C. trachomatis* SWIB protein.

20 Fig. 6 illustrates the 5' and 3' primer sequences designed from *C. pneumoniae* which were used to isolate the SWIB and S13 genes from *C. pneumoniae*.

Figs. 7A and 7B show induction of IFN- $\gamma$  from a human anti-*chlamydia* T-cell line (TCL-8) capable of cross-reacting to *C. trachomatis* and *C. pneumonia* upon activation by monocyte-derived dendritic cells expressing chlamydial proteins.

25 Fig. 8 shows the identification of T cell epitopes in Chlamydial ribosomal S13 protein with T-cell line TCL 8 EB/DC.

Fig. 9 illustrates the proliferative response of CP-21 T-cells generated against *C. pneumoniae*-infected dendritic cells to recombinant *C. pneumonia*-SWIBprotein, but not *C. trachomatis* SWIB protein.

30 Fig. 10 shows the *C. trachomatis*-specific SWIB proliferative responses of a primary T-cell line (TCT-10 EB) from an asymptomatic donor.

Fig. 11 illustrates the identification of T-cell epitope in *C. trachomatis* SWIB with an antigen specific T-cell line (TCL-10 EB).

## DETAILED DESCRIPTION OF THE INVENTION

As noted above, the present invention is generally directed to compositions and methods for the diagnosis and treatment of Chlamydial infection. In one aspect, the compositions of the subject invention include polypeptides that  
5 comprise at least one immunogenic portion of a *Chlamydia* antigen, or a variant thereof.

In specific embodiments, the subject invention discloses polypeptides comprising an immunogenic portion of a *Chlamydia* antigen, wherein the *Chlamydia* antigen comprises an amino acid sequence encoded by a polynucleotide molecule including a sequence selected from the group consisting of (a) nucleotide sequences  
10 recited in SEQ ID NO: 1, 15, 21-25, 44-64, 66-76, 79-88, 110-119, 120, 122, 124, 126, 128, 130, 132, 134, 136, 169-174, 181-188, 263, 265 and 267-290 (b) the complements of said nucleotide sequences, and (c) variants of such sequences.

As used herein, the term "polypeptide" encompasses amino acid chains of any length, including full length proteins (*i.e.*, antigens), wherein the amino acid  
15 residues are linked by covalent peptide bonds. Thus, a polypeptide comprising an immunogenic portion of one of the inventive antigens may consist entirely of the immunogenic portion, or may contain additional sequences. The additional sequences may be derived from the native *Chlamydia* antigen or may be heterologous, and such sequences may (but need not) be immunogenic.

The term "polynucleotide(s)," as used herein, means a single or double-stranded polymer of deoxyribonucleotide or ribonucleotide bases and includes DNA and corresponding RNA molecules, including HnRNA and mRNA molecules, both sense and anti-sense strands, and comprehends cDNA, genomic DNA and recombinant DNA, as well as wholly or partially synthesized polynucleotides. An HnRNA molecule  
25 contains introns and corresponds to a DNA molecule in a generally one-to-one manner. An mRNA molecule corresponds to an HnRNA and DNA molecule from which the introns have been excised. A polynucleotide may consist of an entire gene, or any portion thereof. Operable anti-sense polynucleotides may comprise a fragment of the corresponding polynucleotide, and the definition of "polynucleotide" therefore includes  
30 all such operable anti-sense fragments.

An "immunogenic portion" of an antigen is a portion that is capable of reacting with sera obtained from a *Chlamydia*-infected individual (*i.e.*, generates an absorbance reading with sera from infected individuals that is at least three standard deviations above the absorbance obtained with sera from uninfected individuals, in a  
35 representative ELISA assay described herein). Such immunogenic portions generally comprise at least about 5 amino acid residues, more preferably at least about 10, and



most preferably at least about 20 amino acid residues. Methods for preparing and identifying immunogenic portions of antigens of known sequence are well known in the art and include those summarized in Paul, *Fundamental Immunology*, 3<sup>rd</sup> ed., Raven Press, 1993, pp. 243-247 and references cited therein. Such techniques include  
5 screening polypeptides for the ability to react with antigen-specific antibodies, antisera and/or T-cell lines or clones. As used herein, antisera and antibodies are "antigen-specific" if they specifically bind to an antigen (*i.e.*, they react with the protein in an ELISA or other immunoassay, and do not react detectably with unrelated proteins). Such antisera and antibodies may be prepared as described herein, and using well  
10 known techniques. An immunogenic portion of a native *Chlamydia* protein is a portion that reacts with such antisera and/or T-cells at a level that is not substantially less than the reactivity of the full length polypeptide (*e.g.*, in an ELISA and/or T-cell reactivity assay). Such immunogenic portions may react within such assays at a level that is similar to or greater than the reactivity of the full length polypeptide. Such screens may  
15 generally be performed using methods well known to those of ordinary skill in the art, such as those described in Harlow and Lane, *Antibodies: A Laboratory Manual*, Cold Spring Harbor Laboratory, 1988. For example, a polypeptide may be immobilized on a solid support and contacted with patient sera to allow binding of antibodies within the sera to the immobilized polypeptide. Unbound sera may then be removed and bound  
20 antibodies detected using, for example, <sup>125</sup>I-labeled Protein A.

Examples of immunogenic portions of antigens contemplated by the present invention include, for example, the T cell stimulating epitopes provided in SEQ ID NO: 9, 10, 18, 19, 31, 39, 93-96, 98, 100-102, 106, 108, 138-140, 158, 167, 168, 246, 247 and 254-256. Polypeptides comprising at least an immunogenic portion of one  
25 or more *Chlamydia* antigens as described herein may generally be used, alone or in combination, to detect Chlamydial infection in a patient.

The compositions and methods of the present invention also encompass variants of the above polypeptides and polynucleotide molecules. Such variants include, but are not limited to, naturally occurring allelic variants of the inventive  
30 sequences. In particular, variants include other *Chlamydiae* serovars, such as serovars D, E and F, as well as the several LGV serovars which share homology to the inventive polypeptide and polynucleotide molecules described herein. Preferably, the serovar homologues show 95-99% homology to the corresponding polypeptide sequence(s) described herein.

35 A polypeptide "variant," as used herein, is a polypeptide that differs from the recited polypeptide only in conservative substitutions and/or modifications, such

that the antigenic properties of the polypeptide are retained. In a preferred embodiment, variant polypeptides differ from an identified sequence by substitution, deletion or addition of five amino acids or fewer. Such variants may generally be identified by modifying one of the above polypeptide sequences, and evaluating the antigenic properties of the modified polypeptide using, for example, the representative procedures described herein. In other words, the ability of a variant to react with antigen-specific antisera may be enhanced or unchanged, relative to the native protein, or may be diminished by less than 50%, and preferably less than 20%, relative to the native protein. Such variants may generally be identified by modifying one of the above polypeptide sequences and evaluating the reactivity of the modified polypeptide with antigen-specific antibodies or antisera as described herein. Preferred variants include those in which one or more portions, such as an N-terminal leader sequence or transmembrane domain, have been removed. Other preferred variants include variants in which a small portion (*e.g.*, 1-30 amino acids, preferably 5-15 amino acids) has been removed from the N- and/or C-terminal of the mature protein.

As used herein, a "conservative substitution" is one in which an amino acid is substituted for another amino acid that has similar properties, such that one skilled in the art of peptide chemistry would expect the secondary structure and hydrophobic nature of the polypeptide to be substantially unchanged. Amino acid substitutions may generally be made on the basis of similarity in polarity, charge, solubility, hydrophobicity, hydrophilicity and/or the amphipathic nature of the residues. For example, negatively charged amino acids include aspartic acid and glutamic acid; positively charged amino acids include lysine and arginine; and amino acids with uncharged polar head groups having similar hydrophilicity values include leucine, isoleucine and valine; glycine and alanine; asparagine and glutamine; and serine, threonine, phenylalanine and tyrosine. Other groups of amino acids that may represent conservative changes include: (1) ala, pro, gly, glu, asp, gln, asn, ser, thr; (2) cys, ser, tyr, thr; (3) val, ile, leu, met, ala, phe; (4) lys, arg, his; and (5) phe, tyr, trp, his. A variant may also, or alternatively, contain nonconservative changes. In a preferred embodiment, variant polypeptides differ from a native sequence by substitution, deletion or addition of five amino acids or fewer. Variants may also (or alternatively) be modified by, for example, the deletion or addition of amino acids that have minimal influence on the immunogenicity, secondary structure and hydrophobic nature of the polypeptide. Variants may also, or alternatively, contain other modifications, including the deletion or addition of amino acids that have minimal influence on the antigenic properties, secondary structure and hydrophobic nature of the polypeptide. For example,

a polypeptide may be conjugated to a signal (or leader) sequence at the N-terminal end of the protein which co-translationally or post-translationally directs transfer of the protein. The polypeptide may also be conjugated to a linker or other sequence for ease of synthesis, purification or identification of the polypeptide (*e.g.*, poly-His), or to  
5 enhance binding of the polypeptide to a solid support. For example, a polypeptide may be conjugated to an immunoglobulin Fc region.

A polynucleotide "variant" is a sequence that differs from the recited nucleotide sequence in having one or more nucleotide deletions, substitutions or additions such that the immunogenicity of the encoded polypeptide is not diminished,  
10 relative to the native protein. The effect on the immunogenicity of the encoded polypeptide may generally be assessed as described herein. Such modifications may be readily introduced using standard mutagenesis techniques, such as oligonucleotide-directed site-specific mutagenesis as taught, for example, by Adelman et al. (*DNA*, 2:183, 1983). Nucleotide variants may be naturally occurring allelic variants as  
15 discussed below, or non-naturally occurring variants. The polypeptides provided by the present invention include variants that are encoded by polynucleotide sequences which are substantially homologous to one or more of the polynucleotide sequences specifically recited herein. "Substantial homology," as used herein, refers to polynucleotide sequences that are capable of hybridizing under moderately stringent  
20 conditions. Suitable moderately stringent conditions include prewashing in a solution of 5X SSC, 0.5% SDS, 1.0 mM EDTA (pH 8.0); hybridizing at 50°C-65°C, 5X SSC, overnight or, in the event of cross-species homology, at 45°C with 0.5X SSC; followed by washing twice at 65°C for 20 minutes with each of 2X, 0.5X and 0.2X SSC containing 0.1% SDS. Such hybridizing polynucleotide sequences are also within the  
25 scope of this invention, as are nucleotide sequences that, due to code degeneracy, encode a polypeptide that is the same as a polypeptide of the present invention.

Two nucleotide or polypeptide sequences are said to be "identical" if the sequence of nucleotides or amino acid residues in the two sequences is the same when aligned for maximum correspondence as described below. Comparisons between two  
30 sequences are typically performed by comparing the sequences over a comparison window to identify and compare local regions of sequence similarity. A "comparison window" as used herein, refers to a segment of at least about 20 contiguous positions, usually 30 to about 75, 40 to about 50, in which a sequence may be compared to a reference sequence of the same number of contiguous positions after the two sequences  
35 are optimally aligned.

Optimal alignment of sequences for comparison may be conducted using the Megalign program in the Lasergene suite of bioinformatics software (DNASTAR, Inc., Madison, WI), using default parameters. This program embodies several alignment schemes described in the following references: Dayhoff, M.O. (1978) A  
 5 model of evolutionary change in proteins – Matrices for detecting distant relationships. In Dayhoff, M.O. (ed.) *Atlas of Protein Sequence and Structure*, National Biomedical Research Foundation, Washington DC Vol. 5, Suppl. 3, pp. 345-358; Hein J. (1990) Unified Approach to Alignment and Phylogenies pp. 626-645 *Methods in Enzymology* vol. 183, Academic Press, Inc., San Diego, CA; Higgins, D.G. and Sharp, P.M. (1989)  
 10 Fast and sensitive multiple sequence alignments on a microcomputer *CABIOS* 5:151-153; Myers, E.W. and Muller W. (1988) Optimal alignments in linear space *CABIOS* 4:11-17; Robinson, E.D. (1971) *Comb. Theor* 11:105; Santou, N. Nes, M. (1987) The neighbor joining method. A new method for reconstructing phylogenetic trees *Mol. Biol. Evol.* 4:406-425; Sneath, P.H.A. and Sokal, R.R. (1973) *Numerical Taxonomy – the Principles and Practice of Numerical Taxonomy*, Freeman Press, San Francisco, CA; Wilbur, W.J. and Lipman, D.J. (1983) Rapid similarity searches of nucleic acid and  
 15 protein data banks *Proc. Natl. Acad. Sci. USA* 80:726-730.

Alternatively, optimal alignment of sequences for comparison may be conducted by the local identity algorithm of Smith and Waterman (1981) *Add. APL. Math* 2:482, by the identity alignment algorithm of Needleman and Wunsch (1970) *J. Mol. Biol.* 48:443, by the search for similarity methods of Pearson and Lipman (1988) *Proc. Natl. Acad. Sci. (U.S.A.)* 85: 2444, by computerized implementations of these algorithms (GAP, BESTFIT, BLAST, FASTA, and TFASTA in the Wisconsin Genetics Software Package, Genetics Computer Group (GCG), 575 Science Dr., Madison, WI),  
 20 or by inspection.

One illustrative example of algorithms that are suitable for determining percent sequence identity and sequence similarity are the BLAST and BLAST 2.0 algorithms, which are described in Altschul et al. (1977) *Nuc. Acids Res.* 25:3389-3402 and Altschul et al. (1990) *J. Mol. Biol.* 215:403-410, respectively. BLAST and BLAST  
 30 2.0 can be used, for example with the parameters described herein, to determine percent sequence identity for the polynucleotides and polypeptides of the invention. Software for performing BLAST analyses is publicly available through the National Center for Biotechnology Information (<http://www.ncbi.nlm.nih.gov/>) In one illustrative example, cumulative scores can be calculated using, for nucleotide sequences, the parameters M (reward score for a pair of matching residues; always >0) and N (penalty score for mismatching residues; always <0). For amino acid sequences, a scoring matrix can be  
 35

used to calculate the cumulative score. Extension of the word hits in each direction are halted when: the cumulative alignment score falls off by the quantity X from its maximum achieved value; the cumulative score goes to zero or below, due to the accumulation of one or more negative-scoring residue alignments; or the end of either  
5 sequence is reached. The BLAST algorithm parameters W, T and X determine the sensitivity and speed of the alignment. The BLASTN program (for nucleotide sequences) uses as defaults a wordlength (W) of 11, and expectation (E) of 10, and the BLOSUM62 scoring matrix (see Henikoff and Henikoff (1989) Proc. Natl. Acad. Sci. USA 89:10915) alignments, (B) of 50, expectation (E) of 10, M=5, N=-4 and a  
10 comparison of both strands.

Preferably, the "percentage of sequence identity" is determined by comparing two optimally aligned sequences over a window of comparison of at least 20 positions, wherein the portion of the polynucleotide or amino acid sequence in the comparison window may comprise additions or deletions (i.e. gaps) of 20 percent or  
15 less, usually 5 to 15 percent, or 10 to 12 percent, as compared to the reference sequences (which does not comprise additions or deletions) for optimal alignment of the two sequences. The percentage is calculated by determining the number of positions at which the identical nucleic acid bases or amino acid residue occurs in both sequences to yield the number of matched positions, dividing the number of matched positions by the  
20 total number of positions in the reference sequence (i.e. the window size) and multiplying the results by 100 to yield the percentage of sequence identity.

Therefore, the present invention provides polynucleotide and polypeptide sequences having substantial identity to the sequences disclosed herein, for example those comprising at least 50% or more sequence identity, preferably at least 55%, 60%,  
25 65%, 70%, 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, or 99% or higher, sequence identity compared to a polynucleotide or polypeptide sequence of this invention using the methods described herein, (e.g., BLAST analysis using standard parameters, as described below). One skilled in this art will recognize that these values can be appropriately adjusted to determine corresponding identity of proteins encoded by two  
30 polynucleotide sequences by taking into account codon degeneracy, amino acid similarity, reading frame positioning and the like.

In additional embodiments, the present invention provides isolated polynucleotides or polypeptides comprising various lengths of contiguous stretches of sequence identical to or complementary to one or more of the sequences disclosed  
35 herein. For example, polynucleotides and polypeptides encompassed by this invention may comprise at least about 15, 20, 30, 40, 50, 75, 100, 150, 200, 300, 400, 500 or 1000

or more contiguous nucleotides of one or more of the disclosed sequences, as well as all intermediate lengths therebetween. It will be readily understood that "intermediate lengths", in this context, means any length between the quoted values, such as 16, 17, 18, 19, *etc.*; 21, 22, 23, *etc.*; 30, 31, 32, *etc.*; 50, 51, 52, 53, *etc.*; 100, 101, 102, 103, 5 *etc.*; 150, 151, 152, 153, *etc.*; including all integers through the 200-500; 500-1,000, and the like.

The polynucleotides of the present invention, or fragments thereof, regardless of the length of the coding sequence itself, may be combined with other DNA sequences, such as promoters, polyadenylation signals, additional restriction 10 enzyme sites, multiple cloning sites, other coding segments, and the like, such that their overall length may vary considerably. It is therefore contemplated that a nucleic acid fragment of almost any length may be employed, with the total length preferably being limited by the ease of preparation and use in the intended recombinant DNA protocol. For example, illustrative DNA segments with total lengths of about 10,000, about 5000, 15 about 3000, about 2,000, about 1,000, about 500, about 200, about 100, about 50 base pairs in length, and the like, (including all intermediate lengths) are contemplated to be useful in many implementations of this invention.

Also included in the scope of the present invention are alleles of the genes encoding the nucleotide sequences recited in herein. As used herein, an "allele" 20 or "allelic sequence" is an alternative form of the gene which may result from at least one mutation in the nucleic acid sequence. Alleles may result in altered mRNAs or polypeptides whose structure or function may or may not be altered. Any given gene may have none, one, or many allelic forms. Common mutational changes which give rise to alleles are generally ascribed to natural deletions, additions, or substitutions of 25 nucleotides. Each of these types of changes may occur alone or in combination with the others, one or more times in a given sequence. In specific embodiments, the subject invention discloses polypeptides comprising at least an immunogenic portion of a *Chlamydia* antigen (or a variant of such an antigen), that comprises one or more of the amino acid sequences encoded by (a) a polynucleotide sequence selected from the 30 group consisting of SEQ ID NO: 1-4, 15 21-25, 44-64, 66-76 and 79-88; (b) the complements of such DNA sequences or (c) DNA sequences substantially homologous to a sequence in (a) or (b). As discussed in the Examples below, several of the *Chlamydia* antigens disclosed herein recognize a T cell line that recognizes both *Chlamydia trachomatis* and *Chlamydia pneumoniae* infected monocyte-derived 35 dendritic cells, indicating that they may represent an immunoreactive epitope shared by *Chlamydia trachomatis* and *Chlamydia pneumoniae*. The antigens may thus be

employed in a vaccine for both *C. trachomatis* genital tract infections and for *C. pneumonia* infections. Further characterization of these *Chlamydia* antigens from *Chlamydia trachomatis* and *Chlamydia pneumonia* to determine the extent of cross-reactivity is provided in Example 6. Additionally, Example 4 describes cDNA fragments (SEQ ID NO: 15, 16 and 33) isolated from *C. trachomatis* which encode proteins (SEQ ID NO: 17-19 and 32) capable of stimulating a *Chlamydia*-specific murine CD8+ T cell line.

In general, *Chlamydia* antigens, and polynucleotide sequences encoding such antigens, may be prepared using any of a variety of procedures. For example, polynucleotide molecules encoding *Chlamydia* antigens may be isolated from a *Chlamydia* genomic or cDNA expression library by screening with a *Chlamydia*-specific T cell line as described below, and sequenced using techniques well known to those of skill in the art. Additionally, a polynucleotide may be identified, as described in more detail below, by screening a microarray of cDNAs for *Chlamydia*-associated expression (*i.e.*, expression that is at least two fold greater in *Chlamydia*-infected cells than in controls, as determined using a representative assay provided herein). Such screens may be performed using a Synteni microarray (Palo Alto, CA) according to the manufacturer's instructions (and essentially as described by Schena et al., *Proc. Natl. Acad. Sci. USA* 93:10614-10619, 1996 and Heller et al., *Proc. Natl. Acad. Sci. USA* 94:2150-2155, 1997). Alternatively, polypeptides may be amplified from cDNA prepared from cells expressing the proteins described herein.. Such polynucleotides may be amplified via polymerase chain reaction (PCR). For this approach, sequence-specific primers may be designed based on the sequences provided herein, and may be purchased or synthesized.

Antigens may be produced recombinantly, as described below, by inserting a polynucleotide sequence that encodes the antigen into an expression vector and expressing the antigen in an appropriate host. Antigens may be evaluated for a desired property, such as the ability to react with sera obtained from a *Chlamydia*-infected individual as described herein, and may be sequenced using, for example, traditional Edman chemistry. See Edman and Berg, *Eur. J. Biochem.* 80:116-132, 1967.

Polynucleotide sequences encoding antigens may also be obtained by screening an appropriate *Chlamydia* cDNA or genomic DNA library for polynucleotide sequences that hybridize to degenerate oligonucleotides derived from partial amino acid sequences of isolated antigens. Degenerate oligonucleotide sequences for use in such a screen may be designed and synthesized, and the screen may be performed, as described (for example) in Sambrook et al., *Molecular Cloning: A Laboratory Manual*, Cold

Spring Harbor Laboratories, Cold Spring Harbor, NY (and references cited therein). Polymerase chain reaction (PCR) may also be employed, using the above oligonucleotides in methods well known in the art, to isolate a nucleic acid probe from a cDNA or genomic library. The library screen may then be performed using the isolated  
5 probe.

An amplified portion may be used to isolate a full length gene from a suitable library (*e.g.*, a *Chlamydia* cDNA library) using well known techniques. Within such techniques, a library (cDNA or genomic) is screened using one or more polynucleotide probes or primers suitable for amplification. Preferably, a library is  
10 size-selected to include larger molecules. Random primed libraries may also be preferred for identifying 5' and upstream regions of genes. Genomic libraries are preferred for obtaining introns and extending 5' sequences.

For hybridization techniques, a partial sequence may be labeled (*e.g.*, by nick-translation or end-labeling with  $^{32}\text{P}$ ) using well known techniques. A bacterial or  
15 bacteriophage library is then screened by hybridizing filters containing denatured bacterial colonies (or lawns containing phage plaques) with the labeled probe (*see* Sambrook et al., *Molecular Cloning: A Laboratory Manual*, Cold Spring Harbor Laboratories, Cold Spring Harbor, NY, 1989). Hybridizing colonies or plaques are selected and expanded, and the DNA is isolated for further analysis. cDNA clones may  
20 be analyzed to determine the amount of additional sequence by, for example, PCR using a primer from the partial sequence and a primer from the vector. Restriction maps and partial sequences may be generated to identify one or more overlapping clones. The complete sequence may then be determined using standard techniques, which may involve generating a series of deletion clones. The resulting overlapping sequences are  
25 then assembled into a single contiguous sequence. A full length cDNA molecule can be generated by ligating suitable fragments, using well known techniques.

Alternatively, there are numerous amplification techniques for obtaining a full length coding sequence from a partial cDNA sequence. Within such techniques, amplification is generally performed via PCR. Any of a variety of commercially  
30 available kits may be used to perform the amplification step. Primers may be designed using techniques well known in the art (*see*, for example, Mullis et al., *Cold Spring Harbor Symp. Quant. Biol.* 51:263, 1987; Erlich ed., *PCR Technology*, Stockton Press, NY, 1989), and software well known in the art may also be employed. Primers are preferably 22-30 nucleotides in length, have a GC content of at least 50% and anneal to  
35 the target sequence at temperatures of about 68°C to 72°C. The amplified region may



be sequenced as described above, and overlapping sequences assembled into a contiguous sequence.

One such amplification technique is inverse PCR (*see* Triglia et al., *Nucl. Acids Res.* 16:8186, 1988), which uses restriction enzymes to generate a fragment in the known region of the gene. The fragment is then circularized by intramolecular ligation and used as a template for PCR with divergent primers derived from the known region. Within an alternative approach, sequences adjacent to a partial sequence may be retrieved by amplification with a primer to a linker sequence and a primer specific to a known region. The amplified sequences are typically subjected to a second round of amplification with the same linker primer and a second primer specific to the known region. A variation on this procedure, which employs two primers that initiate extension in opposite directions from the known sequence, is described in WO 96/38591. Additional techniques include capture PCR (Lagerstrom et al., *PCR Methods Applic.* 1:111-19, 1991) and walking PCR (Parker et al., *Nucl. Acids. Res.* 19:3055-60, 1991). Transcription-Mediated Amplification, or TMA is another method that may be utilized for the amplification of DNA, rRNA, or mRNA, as described in Patent No. PCT/US91/03184. This autocatalytic and isothermal non-PCR based method utilizes two primers and two enzymes: RNA polymerase and reverse transcriptase. One primer contains a promoter sequence for RNA polymerase. In the first amplification, the promoter-primer hybridizes to the target rRNA at a defined site. Reverse transcriptase creates a DNA copy of the target rRNA by extension from the 3' end of the promoter-primer. The RNA in the resulting complex is degraded and a second primer binds to the DNA copy. A new strand of DNA is synthesized from the end of the primer by reverse transcriptase creating double stranded DNA. RNA polymerase recognizes the promoter sequence in the DNA template and initiates transcription. Each of the newly synthesized RNA amplicons re-enters the TMA process and serves as a template for a new round of replication leading to the exponential expansion of the RNA amplicon. Other methods employing amplification may also be employed to obtain a full length cDNA sequence.

In certain instances, it is possible to obtain a full length cDNA sequence by analysis of sequences provided in an expressed sequence tag (EST) database, such as that available from GenBank. Searches for overlapping ESTs may generally be performed using well known programs (*e.g.*, NCBI BLAST searches), and such ESTs may be used to generate a contiguous full length sequence. Full length cDNA sequences may also be obtained by analysis of genomic fragments.

Polynucleotide variants may generally be prepared by any method known in the art, including chemical synthesis by, for example, solid phase phosphoramidite chemical synthesis. Modifications in a polynucleotide sequence may also be introduced using standard mutagenesis techniques, such as oligonucleotide-directed site-specific mutagenesis (see Adelman et al., *DNA* 2:183, 1983). Alternatively, RNA molecules may be generated by *in vitro* or *in vivo* transcription of DNA sequences encoding a *Chlamydial* protein, or portion thereof, provided that the DNA is incorporated into a vector with a suitable RNA polymerase promoter (such as T7 or SP6). Certain portions may be used to prepare an encoded polypeptide, as described herein. In addition, or alternatively, a portion may be administered to a patient such that the encoded polypeptide is generated *in vivo* (e.g., by transfecting antigen-presenting cells, such as dendritic cells, with a cDNA construct encoding a *Chlamydial* polypeptide, and administering the transfected cells to the patient).

A portion of a sequence complementary to a coding sequence (i.e., an antisense polynucleotide) may also be used as a probe or to modulate gene expression. cDNA constructs that can be transcribed into antisense RNA may also be introduced into cells of tissues to facilitate the production of antisense RNA. An antisense polynucleotide may be used, as described herein, to inhibit expression of a *Chlamydial* protein. Antisense technology can be used to control gene expression through triple-helix formation, which compromises the ability of the double helix to open sufficiently for the binding of polymerases, transcription factors or regulatory molecules (see Gee et al., In Huber and Carr, *Molecular and Immunologic Approaches*, Futura Publishing Co. (Mt. Kisco, NY; 1994)). Alternatively, an antisense molecule may be designed to hybridize with a control region of a gene (e.g., promoter, enhancer or transcription initiation site), and block transcription of the gene; or to block translation by inhibiting binding of a transcript to ribosomes.

A portion of a coding sequence, or of a complementary sequence, may also be designed as a probe or primer to detect gene expression. Probes may be labeled with a variety of reporter groups, such as radionuclides and enzymes, and are preferably at least 10 nucleotides in length, more preferably at least 20 nucleotides in length and still more preferably at least 30 nucleotides in length. Primers, as noted above, are preferably 22-30 nucleotides in length.

Any polynucleotide may be further modified to increase stability *in vivo*. Possible modifications include, but are not limited to, the addition of flanking sequences at the 5' and/or 3' ends; the use of phosphorothioate or 2' O-methyl rather than phosphodiesterase linkages in the backbone; and/or the inclusion of nontraditional

bases such as inosine, queosine and wybutosine, as well as acetyl- methyl-, thio- and other modified forms of adenine, cytidine, guanine, thymine and uridine.

Nucleotide sequences as described herein may be joined to a variety of other nucleotide sequences using established recombinant DNA techniques. For example, a polynucleotide may be cloned into any of a variety of cloning vectors, including plasmids, phagemids, lambda phage derivatives and cosmids. Vectors of particular interest include expression vectors, replication vectors, probe generation vectors and sequencing vectors. In general, a vector will contain an origin of replication functional in at least one organism, convenient restriction endonuclease sites and one or more selectable markers. Other elements will depend upon the desired use, and will be apparent to those of ordinary skill in the art.

Synthetic polypeptides having fewer than about 100 amino acids, and generally fewer than about 50 amino acids, may be generated using techniques well known in the art. For example, such polypeptides may be synthesized using any of the commercially available solid-phase techniques, such as the Merrifield solid-phase synthesis method, where amino acids are sequentially added to a growing amino acid chain. See Merrifield, *J. Am. Chem. Soc.* 85:2149-2146, 1963. Equipment for automated synthesis of polypeptides is commercially available from suppliers such as Perkin Elmer/Applied BioSystems Division, Foster City, CA, and may be operated according to the manufacturer's instructions.

As noted above, immunogenic portions of *Chlamydia* antigens may be prepared and identified using well known techniques, such as those summarized in Paul, *Fundamental Immunology*, 3d ed., Raven Press, 1993, pp. 243-247 and references cited therein. Such techniques include screening polypeptide portions of the native antigen for immunogenic properties. The representative ELISAs described herein may generally be employed in these screens. An immunogenic portion of a polypeptide is a portion that, within such representative assays, generates a signal in such assays that is substantially similar to that generated by the full length antigen. In other words, an immunogenic portion of a *Chlamydia* antigen generates at least about 20%, and preferably about 100%, of the signal induced by the full length antigen in a model ELISA as described herein.

Portions and other variants of *Chlamydia* antigens may be generated by synthetic or recombinant means. Variants of a native antigen may generally be prepared using standard mutagenesis techniques, such as oligonucleotide-directed site-specific mutagenesis. Sections of the polynucleotide sequence may also be removed using standard techniques to permit preparation of truncated polypeptides.

Recombinant polypeptides containing portions and/or variants of a native antigen may be readily prepared from a polynucleotide sequence encoding the polypeptide using a variety of techniques well known to those of ordinary skill in the art. For example, supernatants from suitable host/vector systems which secrete  
5 recombinant protein into culture media may be first concentrated using a commercially available filter. Following concentration, the concentrate may be applied to a suitable purification matrix such as an affinity matrix or an ion exchange resin. Finally, one or more reverse phase HPLC steps can be employed to further purify a recombinant protein.

10 Any of a variety of expression vectors known to those of ordinary skill in the art may be employed to express recombinant polypeptides as described herein. Expression may be achieved in any appropriate host cell that has been transformed or transfected with an expression vector containing a polynucleotide molecule that encodes a recombinant polypeptide. Suitable host cells include prokaryotes, yeast and higher  
15 eukaryotic cells. Preferably, the host cells employed are *E. coli*, yeast or a mammalian cell line, such as COS or CHO. The DNA sequences expressed in this manner may encode naturally occurring antigens, portions of naturally occurring antigens, or other variants thereof.

In general, regardless of the method of preparation, the polypeptides  
20 disclosed herein are prepared in an isolated, substantially pure, form. Preferably, the polypeptides are at least about 80% pure, more preferably at least about 90% pure and most preferably at least about 99% pure.

Within certain specific embodiments, a polypeptide may be a fusion protein that comprises multiple polypeptides as described herein, or that comprises at  
25 least one polypeptide as described herein and an unrelated sequence, such as a known *Chlamydial* protein. A fusion partner may, for example, assist in providing T helper epitopes (an immunological fusion partner), preferably T helper epitopes recognized by humans, or may assist in expressing the protein (an expression enhancer) at higher yields than the native recombinant protein. Certain preferred fusion partners are both  
30 immunological and expression enhancing fusion partners. Other fusion partners may be selected so as to increase the solubility of the protein or to enable the protein to be targeted to desired intracellular compartments. Still further fusion partners include affinity tags, which facilitate purification of the protein. A DNA sequence encoding a fusion protein of the present invention may be constructed using known recombinant  
35 DNA techniques to assemble separate DNA sequences encoding, for example, the first and second polypeptides, into an appropriate expression vector. The 3' end of a DNA

sequence encoding the first polypeptide is ligated, with or without a peptide linker, to the 5' end of a DNA sequence encoding the second polypeptide so that the reading frames of the sequences are in phase to permit mRNA translation of the two DNA sequences into a single fusion protein that retains the biological activity of both the first and the second polypeptides.

A peptide linker sequence may be employed to separate the first and the second polypeptides by a distance sufficient to ensure that each polypeptide folds into its secondary and tertiary structures. Such a peptide linker sequence is incorporated into the fusion protein using standard techniques well known in the art. Suitable peptide linker sequences may be chosen based on the following factors: (1) their ability to adopt a flexible extended conformation; (2) their inability to adopt a secondary structure that could interact with functional epitopes on the first and second polypeptides; and (3) the lack of hydrophobic or charged residues that might react with the polypeptide functional epitopes. Preferred peptide linker sequences contain Gly, Asn and Ser residues. Other near neutral amino acids, such as Thr and Ala may also be used in the linker sequence. Amino acid sequences which may be usefully employed as linkers include those disclosed in Maratea et al., *Gene* 40:39-46, 1985; Murphy et al., *Proc. Natl. Acad. Sci. USA* 83:8258-8562, 1986; U.S. Patent No. 4,935,233 and U.S. Patent No. 4,751,180. The linker sequence may be from 1 to about 50 amino acids in length. As an alternative to the use of a peptide linker sequence (when desired), one can utilize non-essential N-terminal amino acid regions (when present) on the first and second polypeptides to separate the functional domains and prevent steric hindrance.

The ligated DNA sequences are operably linked to suitable transcriptional or translational regulatory elements. The regulatory elements responsible for expression of DNA are located only 5' to the DNA sequence encoding the first polypeptides. Similarly, stop codons required to end translation and transcription termination signals are only present 3' to the DNA sequence encoding the second polypeptide.

Fusion proteins are also provided that comprise a polypeptide of the present invention together with an unrelated immunogenic protein. Preferably the immunogenic protein is capable of eliciting a recall response. Examples of such proteins include tetanus, tuberculosis and hepatitis proteins (*see*, for example, Stoute et al. *New Engl. J. Med.*, 336:86-91, 1997).

Within preferred embodiments, an immunological fusion partner is derived from protein D, a surface protein of the gram-negative bacterium *Haemophilus influenza B* (WO 91/18926). Preferably, a protein D derivative comprises

approximately the first third of the protein (e.g., the first N-terminal 100-110 amino acids), and a protein D derivative may be lipidated. Within certain preferred embodiments, the first 109 residues of a Lipoprotein D fusion partner is included on the N-terminus to provide the polypeptide with additional exogenous T-cell epitopes and to  
5 increase the expression level in *E. coli* (thus functioning as an expression enhancer). The lipid tail ensures optimal presentation of the antigen to antigen presenting cells. Other fusion partners include the non-structural protein from influenzae virus, NS1 (hemagglutinin). Typically, the N-terminal 81 amino acids are used, although different fragments that include T-helper epitopes may be used.

10 In another embodiment, the immunological fusion partner is the protein known as LYTA, or a portion thereof (preferably a C-terminal portion). LYTA is derived from *Streptococcus pneumoniae*, which synthesizes an N-acetyl-L-alanine amidase known as amidase LYTA (encoded by the *LytA* gene; *Gene* 43:265-292, 1986). LYTA is an autolysin that specifically degrades certain bonds in the  
15 peptidoglycan backbone. The C-terminal domain of the LYTA protein is responsible for the affinity to the choline or to some choline analogues such as DEAE. This property has been exploited for the development of *E. coli* C-LYTA expressing plasmids useful for expression of fusion proteins. Purification of hybrid proteins containing the C-LYTA fragment at the amino terminus has been described (see  
20 *Biotechnology* 10:795-798, 1992). Within a preferred embodiment, a repeat portion of LYTA may be incorporated into a fusion protein. A repeat portion is found in the C-terminal region starting at residue 178. A particularly preferred repeat portion incorporates residues 188-305.

In another embodiment, a *Mycobacterium tuberculosis*-derived Ra12  
25 polynucleotide is linked to at least an immunogenic portion of a polynucleotide of this invention. Ra12 compositions and methods for their use in enhancing expression of heterologous polynucleotide sequences is described in U.S. Patent Application 60/158,585, the disclosure of which is incorporated herein by reference in its entirety. Briefly, Ra12 refers to a polynucleotide region that is a subsequence of a  
30 *Mycobacterium tuberculosis* MTB32A nucleic acid. MTB32A is a serine protease of 32 KD molecular weight encoded by a gene in virulent and avirulent strains of *M. tuberculosis*. The nucleotide sequence and amino acid sequence of MTB32A have been described (U.S. Patent Application 60/158,585; see also, Skeiky *et al.*, *Infection and Immun.* (1999) 67:3998-4007, incorporated herein by reference. In one embodiment,  
35 the Ra12 polypeptide used in the production of fusion polypeptides comprises a C-terminal fragment of the MTB32A coding sequence that is effective for enhancing the

expression and/or immunogenicity of heterologous Chlamydial antigenic polypeptides with which it is fused. In another embodiment, the Ra12 polypeptide corresponds to an approximately 14 kD C-terminal fragment of MTB32A comprising some or all of amino acid residues 192 to 323 of MTB32A.

- 5                   Recombinant nucleic acids, which encode a fusion polypeptide comprising a Ra12 polypeptide and a heterologous Chlamydia polypeptide of interest, can be readily constructed by conventional genetic engineering techniques. Recombinant nucleic acids are constructed so that, preferably, a Ra12 polynucleotide sequence is located 5' to a selected heterologous Chlamydia polynucleotide sequence.
- 10                  It may also be appropriate to place a Ra12 polynucleotide sequence 3' to a selected heterologous polynucleotide sequence or to insert a heterologous polynucleotide sequence into a site within a Ra12 polynucleotide sequence.

- In addition, any suitable polynucleotide that encodes a Ra12 or a portion or other variant thereof can be used in constructing recombinant fusion polynucleotides
- 15                  comprising Ra12 and one or more Chlamydia polynucleotides disclosed herein. Preferred Ra12 polynucleotides generally comprise at least about 15 consecutive nucleotides, at least about 30 nucleotides, at least about 60 nucleotides, at least about 100 nucleotides, at least about 200 nucleotides, or at least about 300 nucleotides that encode a portion of a Ra12 polypeptide.

- 20                  Ra12 polynucleotides may comprise a native sequence (*i.e.*, an endogenous sequence that encodes a Ra12 polypeptide or a portion thereof) or may comprise a variant of such a sequence. Ra12 polynucleotide variants may contain one or more substitutions, additions, deletions and/or insertions such that the biological activity of the encoded fusion polypeptide is not substantially diminished, relative to a
- 25                  fusion polypeptide comprising a native Ra12 polypeptide. Variants preferably exhibit at least about 70% identity, more preferably at least about 80% identity and most preferably at least about 90% identity to a polynucleotide sequence that encodes a native Ra12 polypeptide or a portion thereof.

- In another aspect, the present invention provides methods for using one
- 30                  or more of the above polypeptides or fusion proteins (or polynucleotides encoding such polypeptides or fusion proteins) to induce protective immunity against Chlamydial infection in a patient. As used herein, a "patient" refers to any warm-blooded animal, preferably a human. A patient may be afflicted with a disease, or may be free of detectable disease and/or infection. In other words, protective immunity may be
- 35                  induced to prevent or treat Chlamydial infection.

In this aspect, the polypeptide, fusion protein or polynucleotide molecule is generally present within a pharmaceutical composition or a vaccine. Pharmaceutical compositions may comprise one or more polypeptides, each of which may contain one or more of the above sequences (or variants thereof), and a physiologically acceptable carrier. Vaccines may comprise one or more of the above polypeptides and an immunostimulant, such as an adjuvant or a liposome (into which the polypeptide is incorporated). Such pharmaceutical compositions and vaccines may also contain other *Chlamydia* antigens, either incorporated into a combination polypeptide or present within a separate polypeptide.

Alternatively, a vaccine may contain polynucleotides encoding one or more polypeptides or fusion proteins as described above, such that the polypeptide is generated *in situ*. In such vaccines, the polynucleotides may be present within any of a variety of delivery systems known to those of ordinary skill in the art, including nucleic acid expression systems, bacterial and viral expression systems. Appropriate nucleic acid expression systems contain the necessary polynucleotide sequences for expression in the patient (such as a suitable promoter and terminating signal). Bacterial delivery systems involve the administration of a bacterium (such as *Bacillus-Calmette-Guerrin*) that expresses an immunogenic portion of the polypeptide on its cell surface. In a preferred embodiment, the polynucleotides may be introduced using a viral expression system (e.g., vaccinia or other pox virus, retrovirus, or adenovirus), which may involve the use of a non-pathogenic (defective) virus. Techniques for incorporating polynucleotides into such expression systems are well known to those of ordinary skill in the art. The polynucleotides may also be administered as "naked" plasmid vectors as described, for example, in Ulmer et al., *Science* 259:1745-1749, 1993 and reviewed by Cohen, *Science* 259:1691-1692, 1993. Techniques for incorporating DNA into such vectors are well known to those of ordinary skill in the art. A retroviral vector may additionally transfer or incorporate a gene for a selectable marker (to aid in the identification or selection of transduced cells) and/or a targeting moiety, such as a gene that encodes a ligand for a receptor on a specific target cell, to render the vector target specific. Targeting may also be accomplished using an antibody, by methods known to those of ordinary skill in the art.

Other formulations for therapeutic purposes include colloidal dispersion systems, such as macromolecule complexes, nanocapsules, microspheres, beads, and lipid-based systems including oil-in-water emulsions, micelles, mixed micelles, and liposomes. A preferred colloidal system for use as a delivery vehicle *in vitro* and *in vivo* is a liposome (i.e., an artificial membrane vesicle). The uptake of naked



polynucleotides may be increased by incorporating the polynucleotides into and/or onto biodegradable beads, which are efficiently transported into the cells. The preparation and use of such systems is well known in the art.

5 In a related aspect, a polynucleotide vaccine as described above may be administered simultaneously with or sequentially to either a polypeptide of the present invention or a known *Chlamydia* antigen. For example, administration of polynucleotides encoding a polypeptide of the present invention, either "naked" or in a delivery system as described above, may be followed by administration of an antigen in order to enhance the protective immune effect of the vaccine.

10 Polypeptides and polynucleotides disclosed herein may also be employed in adoptive immunotherapy for the treatment of *Chlamydial* infection. Adoptive immunotherapy may be broadly classified into either active or passive immunotherapy. In active immunotherapy, treatment relies on the *in vivo* stimulation of the endogenous host immune system with the administration of immune response-modifying agents (for example, vaccines, bacterial adjuvants, and/or cytokines).

15 In passive immunotherapy, treatment involves the delivery of biologic reagents with established immune reactivity (such as effector cells or antibodies) that can directly or indirectly mediate anti-*Chlamydia* effects and does not necessarily depend on an intact host immune system. Examples of effector cells include T lymphocytes (for example, CD8+ cytotoxic T-lymphocyte, CD4+ T-helper), killer cells (such as Natural Killer cells, lymphokine-activated killer cells), B cells, or antigen presenting cells (such as dendritic cells and macrophages) expressing the disclosed antigens. The polypeptides disclosed herein may also be used to generate antibodies or anti-idiotypic antibodies (as in U.S. Patent No. 4,918,164), for passive immunotherapy.

25 The predominant method of procuring adequate numbers of T-cells for adoptive immunotherapy is to grow immune T-cells *in vitro*. Culture conditions for expanding single antigen-specific T-cells to several billion in number with retention of antigen recognition *in vivo* are well known in the art. These *in vitro* culture conditions typically utilize intermittent stimulation with antigen, often in the presence of cytokines, such as IL-2, and non-dividing feeder cells. As noted above, the immunoreactive polypeptides described herein may be used to rapidly expand antigen-specific T cell cultures in order to generate sufficient number of cells for immunotherapy. In particular, antigen-presenting cells, such as dendritic, macrophage, monocyte, fibroblast, or B-cells, may be pulsed with immunoreactive polypeptides, or  
35 polynucleotide sequence(s) may be introduced into antigen presenting cells, using a variety of standard techniques well known in the art. For example, antigen presenting

cells may be transfected or transduced with a polynucleotide sequence, wherein said sequence contains a promoter region appropriate for increasing expression, and can be expressed as part of a recombinant virus or other expression system. Several viral vectors may be used to transduce an antigen presenting cell, including pox virus, vaccinia virus, and adenovirus; also, antigen presenting cells may be transfected with polynucleotide sequences disclosed herein by a variety of means, including gene-gun technology, lipid-mediated delivery, electroporation, osmotic shock, and particulate delivery mechanisms, resulting in efficient and acceptable expression levels as determined by one of ordinary skill in the art. For cultured T-cells to be effective in therapy, the cultured T-cells must be able to grow and distribute widely and to survive long term *in vivo*. Studies have demonstrated that cultured T-cells can be induced to grow *in vivo* and to survive long term in substantial numbers by repeated stimulation with antigen supplemented with IL-2 (see, for example, Cheever, M., *et al*, "Therapy With Cultured T Cells: Principles Revisited," *Immunological Reviews*, 157:177, 1997).

The polypeptides disclosed herein may also be employed to generate and/or isolate chlamydial-reactive T-cells, which can then be administered to the patient. In one technique, antigen-specific T-cell lines may be generated by *in vivo* immunization with short peptides corresponding to immunogenic portions of the disclosed polypeptides. The resulting antigen specific CD8+ or CD4+ T-cell clones may be isolated from the patient, expanded using standard tissue culture techniques, and returned to the patient.

Alternatively, peptides corresponding to immunogenic portions of the polypeptides may be employed to generate *Chlamydia* reactive T cell subsets by selective *in vitro* stimulation and expansion of autologous T cells to provide antigen-specific T cells which may be subsequently transferred to the patient as described, for example, by Chang *et al*, (*Crit. Rev. Oncol. Hematol.*, 22(3), 213, 1996). Cells of the immune system, such as T cells, may be isolated from the peripheral blood of a patient, using a commercially available cell separation system, such as Isolex™ System, available from Nexell Therapeutics, Inc. Irvine, CA. The separated cells are stimulated with one or more of the immunoreactive polypeptides contained within a delivery vehicle, such as a microsphere, to provide antigen-specific T cells. The population of antigen-specific T cells is then expanded using standard techniques and the cells are administered back to the patient.

In other embodiments, T-cell and/or antibody receptors specific for the polypeptides disclosed herein can be cloned, expanded, and transferred into other vectors or effector cells for use in adoptive immunotherapy. In particular, T cells may

be transfected with the appropriate genes to express the variable domains from chlamydia specific monoclonal antibodies as the extracellular recognition elements and joined to the T cell receptor signaling chains, resulting in T cell activation, specific lysis, and cytokine release. This enables the T cell to redirect its specificity in an MHC-independent manner. See for example, Eshhar, Z., *Cancer Immunol Immunother*, 45(3-4):131-6, 1997 and Hwu, P., et al, *Cancer Res*, 55(15):3369-73, 1995. Another embodiment may include the transfection of chlamydia antigen specific alpha and beta T cell receptor chains into alternate T cells, as in Cole, DJ, et al, *Cancer Res*, 55(4):748-52, 1995.

10 In a further embodiment, syngeneic or autologous dendritic cells may be pulsed with peptides corresponding to at least an immunogenic portion of a polypeptide disclosed herein. The resulting antigen-specific dendritic cells may either be transferred into a patient, or employed to stimulate T cells to provide antigen-specific T cells which may, in turn, be administered to a patient. The use of peptide-pulsed dendritic cells to  
15 generate antigen-specific T cells and the subsequent use of such antigen-specific T cells to eradicate disease in a murine model has been demonstrated by Cheever et al, *Immunological Reviews*, 157:177, 1997). Additionally, vectors expressing the disclosed polynucleotides may be introduced into stem cells taken from the patient and clonally propagated *in vitro* for autologous transplant back into the same patient.

20 Within certain aspects, polypeptides, polynucleotides, T cells and/or binding agents disclosed herein may be incorporated into pharmaceutical compositions or immunogenic compositions (*i.e.*, vaccines). Alternatively, a pharmaceutical composition may comprise an antigen-presenting cell (*e.g.* a dendritic cell) transfected with a *Chlamydial* polynucleotide such that the antigen presenting cell expresses a  
25 *Chlamydial* polypeptide. Pharmaceutical compositions comprise one or more such compounds and a physiologically acceptable carrier. Vaccines may comprise one or more such compounds and an immunostimulant. An immunostimulant may be any substance that enhances or potentiates an immune response to an exogenous antigen. Examples of immunostimulants include adjuvants, biodegradable microspheres (*e.g.*,  
30 polylactic galactide) and liposomes (into which the compound is incorporated; *see e.g.*, Fullerton, U.S. Patent No. 4,235,877). Vaccine preparation is generally described in, for example, M.F. Powell and M.J. Newman, eds., "Vaccine Design (the subunit and adjuvant approach)," Plenum Press (NY, 1995). Pharmaceutical compositions and vaccines within the scope of the present invention may also contain other compounds,  
35 which may be biologically active or inactive. For example, one or more immunogenic

portions of other *Chlamydial* antigens may be present, either incorporated into a fusion polypeptide or as a separate compound, within the composition or vaccine.

A pharmaceutical composition or vaccine may contain DNA encoding one or more of the polypeptides as described above, such that the polypeptide is generated *in situ*. As noted above, the DNA may be present within any of a variety of delivery systems known to those of ordinary skill in the art, including nucleic acid expression systems, bacteria and viral expression systems. Numerous gene delivery techniques are well known in the art, such as those described by Rolland, *Crit. Rev. Therap. Drug Carrier Systems* 15:143-198, 1998, and references cited therein. Appropriate nucleic acid expression systems contain the necessary DNA sequences for expression in the patient (such as a suitable promoter and terminating signal). Bacterial delivery systems involve the administration of a bacterium (such as *Bacillus-Calmette-Guerrin*) that expresses an immunogenic portion of the polypeptide on its cell surface or secretes such an epitope.

In a preferred embodiment, the DNA may be introduced using a viral expression system (e.g., vaccinia or other pox virus, retrovirus, adenovirus, baculovirus, togavirus, bacteriophage, and the like), which often involves the use of a non-pathogenic (defective), replication competent virus.

For example, many viral expression vectors are derived from viruses of the retroviridae family. This family includes the murine leukemia viruses, the mouse mammary tumor viruses, the human foamy viruses, Rous sarcoma virus, and the immunodeficiency viruses, including human, simian, and feline. Considerations when designing retroviral expression vectors are discussed in Comstock *et al.* (1997).

Excellent murine leukemia virus (MLV)-based viral expression vectors have been developed by Kim *et al.* (1998). In creating the MLV vectors, Kim *et al.* found that the entire *gag* sequence, together with the immediate upstream region, could be deleted without significantly affecting viral packaging or gene expression. Further, it was found that nearly the entire U3 region could be replaced with the immediately-early promoter of human cytomegalovirus without deleterious effects. Additionally, MCR and internal ribosome entry sites (IRES) could be added without adverse effects. Based on their observations, Kim *et al.* have designed a series of MLV-based expression vectors comprising one or more of the features described above.

As more has been learned about human foamy virus (HFV), characteristics of HFV that are favorable for its use as an expression vector have been discovered. These characteristics include the expression of pol by splicing and start of

translation at a defined initiation codon. Other aspects of HFV viral expression vectors are reviewed in Bodem *et al.* (1997).

Murakami *et al.* (1997) describe a Rous sarcoma virus (RSV)-based replication-competent avian retrovirus vectors, IR1 and IR2 to express a heterologous gene at a high level. In these vectors, the IRES derived from encephalomyocarditis virus (EMCV) was inserted between the *env* gene and the heterologous gene. The IR1 vector retains the splice-acceptor site that is present downstream of the *env* gene while the IR2 vector lacks it. Murakami *et al.* have shown high level expression of several different heterologous genes by these vectors.

10 Recently, a number of lentivirus-based retroviral expression vectors have been developed. Kafri *et al.* (1997) have shown sustained expression of genes delivered directly into liver and muscle by a human immunodeficiency virus (HIV)-based expression vector. One benefit of the system is the inherent ability of HIV to transduce non-dividing cells. Because the viruses of Kafri *et al.* are pseudotyped with vesicular stomatitis virus G glycoprotein (VSVG), they can transduce a broad range of tissues and  
15 cell types.

A large number of adenovirus-based expression vectors have been developed, primarily due to the advantages offered by these vectors in gene therapy applications. Adenovirus expression vectors and methods of using such vectors are the  
20 subject of a number of United States patents, including United States Patent No. 5,698,202, United States Patent No. 5,616,326, United States Patent No. 5,585,362, and United States Patent No. 5,518,913, all incorporated herein by reference.

Additional adenoviral constructs are described in Khatri *et al.* (1997) and Tomanin *et al.* (1997). Khatri *et al.* describe novel ovine adenovirus expression vectors  
25 and their ability to infect bovine nasal turbinate and rabbit kidney cells as well as a range of human cell type, including lung and foreskin fibroblasts as well as liver, prostate, breast, colon and retinal lines. Tomanin *et al.* describe adenoviral expression vectors containing the T7 RNA polymerase gene. When introduced into cells containing a heterologous gene operably linked to a T7 promoter, the vectors were able  
30 to drive gene expression from the T7 promoter. The authors suggest that this system may be useful for the cloning and expression of genes encoding cytotoxic proteins.

Poxviruses are widely used for the expression of heterologous genes in mammalian cells. Over the years, the vectors have been improved to allow high expression of the heterologous gene and simplify the integration of multiple  
35 heterologous genes into a single molecule. In an effort to diminish cytopathic effects and to increase safety, vaccinia virus mutant and other poxviruses that undergo abortive

infection in mammalian cells are receiving special attention (Oertli *et al.*, 1997). The use of poxviruses as expression vectors is reviewed in Carroll and Moss (1997).

Togaviral expression vectors, which includes alphaviral expression vectors have been used to study the structure and function of proteins and for protein  
5 production purposes. Attractive features of togaviral expression vectors are rapid and efficient gene expression, wide host range, and RNA genomes (Huang, 1996). Also, recombinant vaccines based on alphaviral expression vectors have been shown to induce a strong humoral and cellular immune response with good immunological memory and protective effects (Tubulekas *et al.*, 1997). Alphaviral expression vectors  
10 and their use are discussed, for example, in Lundstrom (1997).

In one study, Li and Garoff (1996) used Semliki Forest virus (SFV) expression vectors to express retroviral genes and to produce retroviral particles in BHK-21 cells. The particles produced by this method had protease and reverse transcriptase activity and were infectious. Furthermore, no helper virus could be  
15 detected in the virus stocks. Therefore, this system has features that are attractive for its use in gene therapy protocols.

Baculoviral expression vectors have traditionally been used to express heterologous proteins in insect cells. Examples of proteins include mammalian chemokine receptors (Wang *et al.*, 1997), reporter proteins such as green fluorescent  
20 protein (Wu *et al.*, 1997), and FLAG fusion proteins (Wu *et al.*, 1997; Koh *et al.*, 1997). Recent advances in baculoviral expression vector technology, including their use in virion display vectors and expression in mammalian cells is reviewed by Possee (1997). Other reviews on baculoviral expression vectors include Jones and Morikawa (1996) and O'Reilly (1997).

Other suitable viral expression systems are disclosed, for example, in Fisher-Hoch *et al.*, *Proc. Natl. Acad. Sci. USA* 86:317-321, 1989; Flexner *et al.*, *Ann. N.Y. Acad. Sci.* 569:86-103, 1989; Flexner *et al.*, *Vaccine* 8:17-21, 1990; U.S. Patent Nos. 4,603,112, 4,769,330, and 5,017,487; WO 89/01973; U.S. Patent No. 4,777,127; GB 2,200,651; EP 0,345,242; WO 91/02805; Berkner, *Biotechniques* 6:616-627, 1988;  
25 Rosenfeld *et al.*, *Science* 252:431-434, 1991; Kolls *et al.*, *Proc. Natl. Acad. Sci. USA* 91:215-219, 1994; Kass-Eisler *et al.*, *Proc. Natl. Acad. Sci. USA* 90:11498-11502, 1993; Guzman *et al.*, *Circulation* 88:2838-2848, 1993; and Guzman *et al.*, *Cir. Res.* 73:1202-1207, 1993. Techniques for incorporating DNA into such expression systems are well known to those of ordinary skill in the art. In other systems, the DNA may be  
30 introduced as "naked" DNA, as described, for example, in Ulmer *et al.*, *Science* 259:1745-1749, 1993 and reviewed by Cohen, *Science* 259:1691-1692, 1993. The

uptake of naked DNA may be increased by coating the DNA onto biodegradable beads, which are efficiently transported into the cells.

It will be apparent that a vaccine may comprise a polynucleotide and/or a polypeptide component, as desired. It will also be apparent that a vaccine may contain  
5 pharmaceutically acceptable salts of the polynucleotides and/or polypeptides provided herein. Such salts may be prepared from pharmaceutically acceptable non-toxic bases, including organic bases (*e.g.*, salts of primary, secondary and tertiary amines and basic amino acids) and inorganic bases (*e.g.*, sodium, potassium, lithium, ammonium, calcium and magnesium salts). While any suitable carrier known to those of ordinary  
10 skill in the art may be employed in the pharmaceutical compositions of this invention, the type of carrier will vary depending on the mode of administration. Compositions of the present invention may be formulated for any appropriate manner of administration, including for example, topical, oral, nasal, intravenous, intracranial, intraperitoneal, subcutaneous or intramuscular administration. For parenteral administration, such as  
15 subcutaneous injection, the carrier preferably comprises water, saline, alcohol, a fat, a wax or a buffer. For oral administration, any of the above carriers or a solid carrier, such as mannitol, lactose, starch, magnesium stearate, sodium saccharine, talcum, cellulose, glucose, sucrose, and magnesium carbonate, may be employed. Biodegradable microspheres (*e.g.*, polylactate polyglycolate) may also be employed as  
20 carriers for the pharmaceutical compositions of this invention. Suitable biodegradable microspheres are disclosed, for example, in U.S. Patent Nos. 4,897,268 and 5,075,109.

Such compositions may also comprise buffers (*e.g.*, neutral buffered saline or phosphate buffered saline), carbohydrates (*e.g.*, glucose, mannose, sucrose or dextrans), mannitol, proteins, polypeptides or amino acids such as glycine, antioxidants,  
25 bacteriostats, chelating agents such as EDTA or glutathione, adjuvants (*e.g.*, aluminum hydroxide), solutes that render the formulation isotonic, hypotonic or weakly hypertonic with the blood of a recipient, suspending agents, thickening agents and/or preservatives. Alternatively, compositions of the present invention may be formulated as a lyophilizate. Compounds may also be encapsulated within liposomes using well known  
30 technology.

Any of a variety of immunostimulants may be employed in the vaccines of this invention. For example, an adjuvant may be included. Most adjuvants contain a substance designed to protect the antigen from rapid catabolism, such as aluminum hydroxide or mineral oil, and a stimulator of immune responses, such as lipid A,  
35 *Bordetella pertussis* or *Mycobacterium tuberculosis* derived proteins. Suitable adjuvants are commercially available as, for example, Freund's Incomplete Adjuvant

and Complete Adjuvant (Difco Laboratories, Detroit, MI); Merck Adjuvant 65 (Merck and Company, Inc., Rahway, NJ); AS-2 (SmithKline Beecham, Philadelphia, PA); aluminum salts such as aluminum hydroxide gel (alum) or aluminum phosphate; salts of calcium, iron or zinc; an insoluble suspension of acylated tyrosine; acylated sugars; 5 cationically or anionically derivatized polysaccharides; polyphosphazenes; biodegradable microspheres; monophosphoryl lipid A and quil A. Cytokines, such as GM-CSF or interleukin-2, -7, or -12, may also be used as adjuvants.

Within the vaccines provided herein, under select circumstances, the adjuvant composition may be designed to induce an immune response predominantly of 10 the Th1 type or Th2 type. High levels of Th1-type cytokines (*e.g.*, IFN- $\gamma$ , TNF $\alpha$ , IL-2 and IL-12) tend to favor the induction of cell mediated immune responses to an administered antigen. In contrast, high levels of Th2-type cytokines (*e.g.*, IL-4, IL-5, IL-6 and IL-10) tend to favor the induction of humoral immune responses. Following application of a vaccine as provided herein, a patient will support an immune response 15 that includes Th1- and Th2-type responses. Within a preferred embodiment, in which a response is predominantly Th1-type, the level of Th1-type cytokines will increase to a greater extent than the level of Th2-type cytokines. The levels of these cytokines may be readily assessed using standard assays. For a review of the families of cytokines, see Mosmann and Coffman, *Ann. Rev. Immunol.* 7:145-173, 1989.

20 Preferred adjuvants for use in eliciting a predominantly Th1-type response include, for example, a combination of monophosphoryl lipid A, preferably 3-de-O-acylated monophosphoryl lipid A (3D-MPL), together with an aluminum salt. MPL adjuvants are available from Corixa Corporation (Seattle, WA; *see* US Patent Nos. 4,436,727; 4,877,611; 4,866,034 and 4,912,094). CpG-containing oligonucleotides (in 25 which the CpG dinucleotide is unmethylated) also induce a predominantly Th1 response. Such oligonucleotides are well known and are described, for example, in WO 96/02555 and WO 99/33488. Immunostimulatory DNA sequences are also described, for example, by Sato et al., *Science* 273:352, 1996. Another preferred adjuvant is a saponin, preferably QS21 (Aquila Biopharmaceuticals Inc., Framingham, MA), which 30 may be used alone or in combination with other adjuvants. For example, an enhanced system involves the combination of a monophosphoryl lipid A and saponin derivative, such as the combination of QS21 and 3D-MPL as described in WO 94/00153, or a less reactogenic composition where the QS21 is quenched with cholesterol, as described in WO 96/33739. Other preferred formulations comprise an oil-in-water emulsion and 35 tocopherol. A particularly potent adjuvant formulation involving QS21, 3D-MPL and tocopherol in an oil-in-water emulsion is described in WO 95/17210.



Other preferred adjuvants include Montanide ISA 720 (Seppic, France), SAF (Chiron, California, United States), ISCOMS (CSL), MF-59 (Chiron), the SBAS series of adjuvants (*e.g.*, SBAS-2 or SBAS-4, available from SmithKline Beecham, Rixensart, Belgium), Detox (Corixa Corporation; Seattle, WA), RC-529 (Corixa Corporation; Seattle, WA) and other aminoalkyl glucosaminide 4-phosphates (AGPs), such as those described in pending U.S. Patent Application Serial Nos. 08/853,826 and 09/074,720, the disclosures of which are incorporated herein by reference in their entireties.

Any vaccine provided herein may be prepared using well known methods that result in a combination of antigen, immunostimulant and a suitable carrier or excipient. The compositions described herein may be administered as part of a sustained release formulation (*i.e.*, a formulation such as a capsule, sponge or gel (composed of polysaccharides, for example) that effects a slow release of compound following administration). Such formulations may generally be prepared using well known technology (*see, e.g.*, Coombes et al., *Vaccine* 14:1429-1438, 1996) and administered by, for example, oral, rectal or subcutaneous implantation, or by implantation at the desired target site. Sustained-release formulations may contain a polypeptide, polynucleotide or antibody dispersed in a carrier matrix and/or contained within a reservoir surrounded by a rate controlling membrane.

Carriers for use within such formulations are biocompatible, and may also be biodegradable; preferably the formulation provides a relatively constant level of active component release. Such carriers include microparticles of poly(lactide-co-glycolide), as well as polyacrylate, latex, starch, cellulose and dextran. Other delayed-release carriers include supramolecular biovectors, which comprise a non-liquid hydrophilic core (*e.g.*, a cross-linked polysaccharide or oligosaccharide) and, optionally, an external layer comprising an amphiphilic compound, such as a phospholipid (*see e.g.*, U.S. Patent No. 5,151,254 and PCT applications WO 94/20078, WO/94/23701 and WO 96/06638). The amount of active compound contained within a sustained release formulation depends upon the site of implantation, the rate and expected duration of release and the nature of the condition to be treated or prevented.

Any of a variety of delivery vehicles may be employed within pharmaceutical compositions and vaccines to facilitate production of an antigen-specific immune response that targets *Chlamydia*-infected cells. Delivery vehicles include antigen presenting cells (APCs), such as dendritic cells, macrophages, B cells, monocytes and other cells that may be engineered to be efficient APCs. Such cells may, but need not, be genetically modified to increase the capacity for presenting the

antigen, to improve activation and/or maintenance of the T cell response, to have anti-*Chlamydia* effects *per se* and/or to be immunologically compatible with the receiver (*i.e.*, matched HLA haplotype). APCs may generally be isolated from any of a variety of biological fluids and organs, and may be autologous, allogeneic, syngeneic or  
5 xenogeneic cells.

Certain preferred embodiments of the present invention use dendritic cells or progenitors thereof as antigen-presenting cells. Dendritic cells are highly potent APCs (Banchereau and Steinman, *Nature* 392:245-251, 1998) and have been shown to be effective as a physiological adjuvant for eliciting prophylactic or therapeutic  
10 immunity (*see* Timmerman and Levy, *Ann. Rev. Med.* 50:507-529, 1999). In general, dendritic cells may be identified based on their typical shape (stellate *in situ*, with marked cytoplasmic processes (dendrites) visible *in vitro*), their ability to take up, process and present antigens with high efficiency, and their ability to activate naïve T cell responses. Dendritic cells may, of course, be engineered to express specific cell-  
15 surface receptors or ligands that are not commonly found on dendritic cells *in vivo* or *ex vivo*, and such modified dendritic cells are contemplated by the present invention. As an alternative to dendritic cells, secreted vesicles antigen-loaded dendritic cells (called exosomes) may be used within a vaccine (*see* Zitvogel et al., *Nature Med.* 4:594-600, 1998).

20 Dendritic cells and progenitors may be obtained from peripheral blood, bone marrow, lymph nodes, spleen, skin, umbilical cord blood or any other suitable tissue or fluid. For example, dendritic cells may be differentiated *ex vivo* by adding a combination of cytokines such as GM-CSF, IL-4, IL-13 and/or TNF $\alpha$  to cultures of monocytes harvested from peripheral blood. Alternatively, CD34 positive cells  
25 harvested from peripheral blood, umbilical cord blood or bone marrow may be differentiated into dendritic cells by adding to the culture medium combinations of GM-CSF, IL-3, TNF $\alpha$ , CD40 ligand, LPS, flt3 ligand and/or other compound(s) that induce differentiation, maturation and proliferation of dendritic cells.

Dendritic cells are conveniently categorized as "immature" and "mature"  
30 cells, which allows a simple way to discriminate between two well characterized phenotypes. However, this nomenclature should not be construed to exclude all possible intermediate stages of differentiation. Immature dendritic cells are characterized as APC with a high capacity for antigen uptake and processing, which correlates with the high expression of Fc $\gamma$  receptor and mannose receptor. The mature  
35 phenotype is typically characterized by a lower expression of these markers, but a high expression of cell surface molecules responsible for T cell activation such as class I and

class II MHC, adhesion molecules (*e.g.*, CD54 and CD11) and costimulatory molecules (*e.g.*, CD40, CD80, CD86 and 4-1BB).

APCs may generally be transfected with a polynucleotide encoding a *Chlamydial* protein (or portion or other variant thereof) such that the *Chlamydial* polypeptide, or an immunogenic portion thereof, is expressed on the cell surface. Such transfection may take place *ex vivo*, and a composition or vaccine comprising such transfected cells may then be used for therapeutic purposes, as described herein. Alternatively, a gene delivery vehicle that targets a dendritic or other antigen presenting cell may be administered to a patient, resulting in transfection that occurs *in vivo*. *In vivo* and *ex vivo* transfection of dendritic cells, for example, may generally be performed using any methods known in the art, such as those described in WO 97/24447, or the gene gun approach described by Mahvi et al., *Immunology and cell Biology* 75:456-460, 1997. Antigen loading of dendritic cells may be achieved by incubating dendritic cells or progenitor cells with the *Chlamydial* polypeptide, DNA (naked or within a plasmid vector) or RNA; or with antigen-expressing recombinant bacterium or viruses (*e.g.*, vaccinia, fowlpox, adenovirus or lentivirus vectors). Prior to loading, the polypeptide may be covalently conjugated to an immunological partner that provides T cell help (*e.g.*, a carrier molecule). Alternatively, a dendritic cell may be pulsed with a non-conjugated immunological partner, separately or in the presence of the polypeptide.

Routes and frequency of administration of pharmaceutical compositions and vaccines, as well as dosage, will vary from individual to individual. In general, the pharmaceutical compositions and vaccines may be administered by injection (*e.g.*, intracutaneous, intramuscular, intravenous or subcutaneous), intranasally (*e.g.*, by aspiration) or orally. Between 1 and 3 doses may be administered for a 1-36 week period. Preferably, 3 doses are administered, at intervals of 3-4 months, and booster vaccinations may be given periodically thereafter. Alternate protocols may be appropriate for individual patients. A suitable dose is an amount of polypeptide or DNA that, when administered as described above, is capable of raising an immune response in an immunized patient sufficient to protect the patient from *Chlamydial* infection for at least 1-2 years. In general, the amount of polypeptide present in a dose (or produced *in situ* by the DNA in a dose) ranges from about 1 pg to about 100 mg per kg of host, typically from about 10 pg to about 1 mg, and preferably from about 100 pg to about 1 µg. Suitable dose sizes will vary with the size of the patient, but will typically range from about 0.1 mL to about 5 mL.

While any suitable carrier known to those of ordinary skill in the art may be employed in the pharmaceutical compositions of this invention, the type of carrier will vary depending on the mode of administration. For parenteral administration, such as subcutaneous injection, the carrier preferably comprises water, saline, alcohol, a fat, a wax or a buffer. For oral administration, any of the above carriers or a solid carrier, such as mannitol, lactose, starch, magnesium stearate, sodium saccharine, talcum, cellulose, glucose, sucrose, and magnesium carbonate, may be employed. Biodegradable microspheres (e.g., polylactic galactide) may also be employed as carriers for the pharmaceutical compositions of this invention. Suitable biodegradable microspheres are disclosed, for example, in U.S. Patent Nos. 4,897,268 and 5,075,109.

In general, an appropriate dosage and treatment regimen provides the active compound(s) in an amount sufficient to provide therapeutic and/or prophylactic benefit. Such a response can be monitored by establishing an improved clinical outcome in treated patients as compared to non-treated patients. Increases in preexisting immune responses to a *Chlamydial* protein generally correlate with an improved clinical outcome. Such immune responses may generally be evaluated using standard proliferation, cytotoxicity or cytokine assays, which may be performed using samples obtained from a patient before and after treatment.

In another aspect, the present invention provides methods for using the polypeptides described above to diagnose Chlamydial infection. In this aspect, methods are provided for detecting Chlamydial infection in a biological sample, using one or more of the above polypeptides, either alone or in combination. For clarity, the term "polypeptide" will be used when describing specific embodiments of the inventive diagnostic methods. However, it will be clear to one of skill in the art that the fusion proteins of the present invention may also be employed in such methods.

As used herein, a "biological sample" is any antibody-containing sample obtained from a patient. Preferably, the sample is whole blood, sputum, serum, plasma, saliva, cerebrospinal fluid or urine. More preferably, the sample is a blood, serum or plasma sample obtained from a patient. The polypeptides are used in an assay, as described below, to determine the presence or absence of antibodies to the polypeptide(s) in the sample, relative to a predetermined cut-off value. The presence of such antibodies indicates previous sensitization to *Chlamydia* antigens which may be indicative of *Chlamydia*-infection.

In embodiments in which more than one polypeptide is employed, the polypeptides used are preferably complementary (i.e., one component polypeptide will tend to detect infection in samples where the infection would not be detected by another

component polypeptide). Complementary polypeptides may generally be identified by using each polypeptide individually to evaluate serum samples obtained from a series of patients known to be infected with *Chlamydia*. After determining which samples test positive (as described below) with each polypeptide, combinations of two or more polypeptides may be formulated that are capable of detecting infection in most, or all, of the samples tested.

A variety of assay formats are known to those of ordinary skill in the art for using one or more polypeptides to detect antibodies in a sample. See, e.g., Harlow and Lane, *Antibodies: A Laboratory Manual*, Cold Spring Harbor Laboratory, 1988, which is incorporated herein by reference. In a preferred embodiment, the assay involves the use of polypeptide immobilized on a solid support to bind to and remove the antibody from the sample. The bound antibody may then be detected using a detection reagent that contains a reporter group. Suitable detection reagents include antibodies that bind to the antibody/polypeptide complex and free polypeptide labeled with a reporter group (e.g., in a semi-competitive assay). Alternatively, a competitive assay may be utilized, in which an antibody that binds to the polypeptide is labeled with a reporter group and allowed to bind to the immobilized antigen after incubation of the antigen with the sample. The extent to which components of the sample inhibit the binding of the labeled antibody to the polypeptide is indicative of the reactivity of the sample with the immobilized polypeptide.

The solid support may be any solid material known to those of ordinary skill in the art to which the antigen may be attached. For example, the solid support may be a test well in a microtiter plate, or a nitrocellulose or other suitable membrane. Alternatively, the support may be a bead or disc, such as glass, fiberglass, latex or a plastic material such as polystyrene or polyvinylchloride. The support may also be a magnetic particle or a fiber optic sensor, such as those disclosed, for example, in U.S. Patent No. 5,359,681.

The polypeptides may be bound to the solid support using a variety of techniques known to those of ordinary skill in the art. In the context of the present invention, the term "bound" refers to both noncovalent association, such as adsorption, and covalent attachment (which may be a direct linkage between the antigen and functional groups on the support or may be a linkage by way of a cross-linking agent). Binding by adsorption to a well in a microtiter plate or to a membrane is preferred. In such cases, adsorption may be achieved by contacting the polypeptide, in a suitable buffer, with the solid support for a suitable amount of time. The contact time varies with temperature, but is typically between about 1 hour and 1 day. In general,

contacting a well of a plastic microtiter plate (such as polystyrene or polyvinylchloride) with an amount of polypeptide ranging from about 10 ng to about 1 µg, and preferably about 100 ng, is sufficient to bind an adequate amount of antigen.

Covalent attachment of polypeptide to a solid support may generally be achieved by first reacting the support with a bifunctional reagent that will react with both the support and a functional group, such as a hydroxyl or amino group, on the polypeptide. For example, the polypeptide may be bound to supports having an appropriate polymer coating using benzoquinone or by condensation of an aldehyde group on the support with an amine and an active hydrogen on the polypeptide (*see*, *e.g.*, Pierce Immunotechnology Catalog and Handbook, 1991, at A12-A13).

In certain embodiments, the assay is an enzyme linked immunosorbent assay (ELISA). This assay may be performed by first contacting a polypeptide antigen that has been immobilized on a solid support, commonly the well of a microtiter plate, with the sample, such that antibodies to the polypeptide within the sample are allowed to bind to the immobilized polypeptide. Unbound sample is then removed from the immobilized polypeptide and a detection reagent capable of binding to the immobilized antibody-polypeptide complex is added. The amount of detection reagent that remains bound to the solid support is then determined using a method appropriate for the specific detection reagent.

More specifically, once the polypeptide is immobilized on the support as described above, the remaining protein binding sites on the support are typically blocked. Any suitable blocking agent known to those of ordinary skill in the art, such as bovine serum albumin (BSA) or Tween 20™ (Sigma Chemical Co., St. Louis, MO) may be employed. The immobilized polypeptide is then incubated with the sample, and antibody is allowed to bind to the antigen. The sample may be diluted with a suitable diluent, such as phosphate-buffered saline (PBS) prior to incubation. In general, an appropriate contact time (*i.e.*, incubation time) is that period of time that is sufficient to detect the presence of antibody within an HGE-infected sample. Preferably, the contact time is sufficient to achieve a level of binding that is at least 95% of that achieved at equilibrium between bound and unbound antibody. Those of ordinary skill in the art will recognize that the time necessary to achieve equilibrium may be readily determined by assaying the level of binding that occurs over a period of time. At room temperature, an incubation time of about 30 minutes is generally sufficient.

Unbound sample may then be removed by washing the solid support with an appropriate buffer, such as PBS containing 0.1% Tween 20™. Detection reagent may then be added to the solid support. An appropriate detection reagent is any

compound that binds to the immobilized antibody-polypeptide complex and that can be detected by any of a variety of means known to those in the art. Preferably, the detection reagent contains a binding agent (such as, for example, Protein A, Protein G, immunoglobulin, lectin or free antigen) conjugated to a reporter group. Preferred  
5 reporter groups include enzymes (such as horseradish peroxidase), substrates, cofactors, inhibitors, dyes, radionuclides, luminescent groups, fluorescent groups and biotin. The conjugation of binding agent to reporter group may be achieved using standard methods known to those of ordinary skill in the art. Common binding agents may also be purchased conjugated to a variety of reporter groups from many commercial sources  
10 (e.g., Zymed Laboratories, San Francisco, CA, and Pierce, Rockford, IL).

The detection reagent is then incubated with the immobilized antibody-polypeptide complex for an amount of time sufficient to detect the bound antibody. An appropriate amount of time may generally be determined from the manufacturer's instructions or by assaying the level of binding that occurs over a period of time.  
15 Unbound detection reagent is then removed and bound detection reagent is detected using the reporter group. The method employed for detecting the reporter group depends upon the nature of the reporter group. For radioactive groups, scintillation counting or autoradiographic methods are generally appropriate. Spectroscopic methods may be used to detect dyes, luminescent groups and fluorescent groups. Biotin  
20 may be detected using avidin, coupled to a different reporter group (commonly a radioactive or fluorescent group or an enzyme). Enzyme reporter groups may generally be detected by the addition of substrate (generally for a specific period of time), followed by spectroscopic or other analysis of the reaction products.

To determine the presence or absence of anti-*Chlamydia* antibodies in  
25 the sample, the signal detected from the reporter group that remains bound to the solid support is generally compared to a signal that corresponds to a predetermined cut-off value. In one preferred embodiment, the cut-off value is the average mean signal obtained when the immobilized antigen is incubated with samples from an uninfected patient. In general, a sample generating a signal that is three standard deviations above  
30 the predetermined cut-off value is considered positive for *Chlamydia*-infection. In an alternate preferred embodiment, the cut-off value is determined using a Receiver Operator Curve, according to the method of Sackett et al., *Clinical Epidemiology: A Basic Science for Clinical Medicine*, Little Brown and Co., 1985, pp. 106-107. Briefly, in this embodiment, the cut-off value may be determined from a plot of pairs of true  
35 positive rates (i.e., sensitivity) and false positive rates (100%-specificity) that correspond to each possible cut-off value for the diagnostic test result. The cut-off

value on the plot that is the closest to the upper left-hand corner (*i.e.*, the value that encloses the largest area) is the most accurate cut-off value, and a sample generating a signal that is higher than the cut-off value determined by this method may be considered positive. Alternatively, the cut-off value may be shifted to the left along the plot, to  
5 minimize the false positive rate, or to the right, to minimize the false negative rate. In general, a sample generating a signal that is higher than the cut-off value determined by this method is considered positive for Chlamydial infection.

In a related embodiment, the assay is performed in a rapid flow-through or strip test format, wherein the antigen is immobilized on a membrane, such as  
10 nitrocellulose. In the flow-through test, antibodies within the sample bind to the immobilized polypeptide as the sample passes through the membrane. A detection reagent (*e.g.*, protein A-colloidal gold) then binds to the antibody-polypeptide complex as the solution containing the detection reagent flows through the membrane. The detection of bound detection reagent may then be performed as described above. In the  
15 strip test format, one end of the membrane to which polypeptide is bound is immersed in a solution containing the sample. The sample migrates along the membrane through a region containing detection reagent and to the area of immobilized polypeptide. Concentration of detection reagent at the polypeptide indicates the presence of anti-*Chlamydia* antibodies in the sample. Typically, the concentration of detection reagent  
20 at that site generates a pattern, such as a line, that can be read visually. The absence of such a pattern indicates a negative result. In general, the amount of polypeptide immobilized on the membrane is selected to generate a visually discernible pattern when the biological sample contains a level of antibodies that would be sufficient to generate a positive signal in an ELISA, as discussed above. Preferably, the amount of  
25 polypeptide immobilized on the membrane ranges from about 25 ng to about 1  $\mu$ g, and more preferably from about 50 ng to about 500 ng. Such tests can typically be performed with a very small amount (*e.g.*, one drop) of patient serum or blood.

Of course, numerous other assay protocols exist that are suitable for use with the polypeptides of the present invention. The above descriptions are intended to  
30 be exemplary only. One example of an alternative assay protocol which may be usefully employed in such methods is a Western blot, wherein the proteins present in a biological sample are separated on a gel, prior to exposure to a binding agent. Such techniques are well known to those of skill in the art.

The present invention further provides agents, such as antibodies and  
35 antigen-binding fragments thereof, that specifically bind to a *Chlamydial* protein. As used herein, an antibody, or antigen-binding fragment thereof, is said to "specifically



bind" to a *Chlamydial* protein if it reacts at a detectable level (within, for example, an ELISA) with a *Chlamydial* protein, and does not react detectably with unrelated proteins under similar conditions. As used herein, "binding" refers to a noncovalent association between two separate molecules such that a complex is formed. The ability to bind may be evaluated by, for example, determining a binding constant for the formation of the complex. The binding constant is the value obtained when the concentration of the complex is divided by the product of the component concentrations. In general, two compounds are said to "bind," in the context of the present invention, when the binding constant for complex formation exceeds about  $10^3$  L/mol. The binding constant may be determined using methods well known in the art.

Binding agents may be further capable of differentiating between patients with and without a *Chlamydial* infection using the representative assays provided herein. In other words, antibodies or other binding agents that bind to a *Chlamydial* protein will generate a signal indicating the presence of a *Chlamydial* infection in at least about 20% of patients with the disease, and will generate a negative signal indicating the absence of the disease in at least about 90% of individuals without infection. To determine whether a binding agent satisfies this requirement, biological samples (e.g., blood, sera, sputum urine and/or tissue biopsies ) from patients with and without *Chlamydial* infection (as determined using standard clinical tests) may be assayed as described herein for the presence of polypeptides that bind to the binding agent. It will be apparent that a statistically significant number of samples with and without the disease should be assayed. Each binding agent should satisfy the above criteria; however, those of ordinary skill in the art will recognize that binding agents may be used in combination to improve sensitivity.

Any agent that satisfies the above requirements may be a binding agent. For example, a binding agent may be a ribosome, with or without a peptide component, an RNA molecule or a polypeptide. In a preferred embodiment, a binding agent is an antibody or an antigen-binding fragment thereof. Antibodies may be prepared by any of a variety of techniques known to those of ordinary skill in the art. See, e.g., Harlow and Lane, *Antibodies: A Laboratory Manual*, Cold Spring Harbor Laboratory, 1988. In general, antibodies can be produced by cell culture techniques, including the generation of monoclonal antibodies as described herein, or via transfection of antibody genes into suitable bacterial or mammalian cell hosts, in order to allow for the production of recombinant antibodies. In one technique, an immunogen comprising the polypeptide is initially injected into any of a wide variety of mammals (e.g., mice, rats, rabbits, sheep or goats). In this step, the polypeptides of this invention may serve as the immunogen

without modification. Alternatively, particularly for relatively short polypeptides, a superior immune response may be elicited if the polypeptide is joined to a carrier protein, such as bovine serum albumin or keyhole limpet hemocyanin. The immunogen is injected into the animal host, preferably according to a predetermined schedule  
5 incorporating one or more booster immunizations, and the animals are bled periodically. Polyclonal antibodies specific for the polypeptide may then be purified from such antisera by, for example, affinity chromatography using the polypeptide coupled to a suitable solid support.

Monoclonal antibodies specific for an antigenic polypeptide of interest  
10 may be prepared, for example, using the technique of Kohler and Milstein, *Eur. J. Immunol.* 6:511-519, 1976, and improvements thereto. Briefly, these methods involve the preparation of immortal cell lines capable of producing antibodies having the desired specificity (*i.e.*, reactivity with the polypeptide of interest). Such cell lines may be produced, for example, from spleen cells obtained from an animal immunized as  
15 described above. The spleen cells are then immortalized by, for example, fusion with a myeloma cell fusion partner, preferably one that is syngeneic with the immunized animal. A variety of fusion techniques may be employed. For example, the spleen cells and myeloma cells may be combined with a nonionic detergent for a few minutes and then plated at low density on a selective medium that supports the growth of hybrid  
20 cells, but not myeloma cells. A preferred selection technique uses HAT (hypoxanthine, aminopterin, thymidine) selection. After a sufficient time, usually about 1 to 2 weeks, colonies of hybrids are observed. Single colonies are selected and their culture supernatants tested for binding activity against the polypeptide. Hybridomas having high reactivity and specificity are preferred.

25 Monoclonal antibodies may be isolated from the supernatants of growing hybridoma colonies. In addition, various techniques may be employed to enhance the yield, such as injection of the hybridoma cell line into the peritoneal cavity of a suitable vertebrate host, such as a mouse. Monoclonal antibodies may then be harvested from the ascites fluid or the blood. Contaminants may be removed from the antibodies by  
30 conventional techniques, such as chromatography, gel filtration, precipitation, and extraction. The polypeptides of this invention may be used in the purification process in, for example, an affinity chromatography step.

Within certain embodiments, the use of antigen-binding fragments of antibodies may be preferred. Such fragments include Fab fragments, which may be  
35 prepared using standard techniques. Briefly, immunoglobulins may be purified from rabbit serum by affinity chromatography on Protein A bead columns (Harlow and Lane,

*Antibodies: A Laboratory Manual*, Cold Spring Harbor Laboratory, 1988) and digested by papain to yield Fab and Fc fragments. The Fab and Fc fragments may be separated by affinity chromatography on protein A bead columns.

Monoclonal antibodies of the present invention may be coupled to one or  
5 more therapeutic agents. Suitable agents in this regard include radionuclides, differentiation inducers, drugs, toxins, and derivatives thereof. Preferred radionuclides include  $^{90}\text{Y}$ ,  $^{123}\text{I}$ ,  $^{125}\text{I}$ ,  $^{131}\text{I}$ ,  $^{186}\text{Re}$ ,  $^{188}\text{Re}$ ,  $^{211}\text{At}$ , and  $^{212}\text{Bi}$ . Preferred drugs include methotrexate, and pyrimidine and purine analogs. Preferred differentiation inducers include phorbol esters and butyric acid. Preferred toxins include ricin, abrin, diphtheria  
10 toxin, cholera toxin, gelonin, *Pseudomonas* exotoxin, *Shigella* toxin, and pokeweed antiviral protein.

A therapeutic agent may be coupled (*e.g.*, covalently bonded) to a suitable monoclonal antibody either directly or indirectly (*e.g.*, via a linker group). A direct reaction between an agent and an antibody is possible when each possesses a  
15 substituent capable of reacting with the other. For example, a nucleophilic group, such as an amino or sulfhydryl group, on one may be capable of reacting with a carbonyl-containing group, such as an anhydride or an acid halide, or with an alkyl group containing a good leaving group (*e.g.*, a halide) on the other.

Alternatively, it may be desirable to couple a therapeutic agent and an  
20 antibody via a linker group. A linker group can function as a spacer to distance an antibody from an agent in order to avoid interference with binding capabilities. A linker group can also serve to increase the chemical reactivity of a substituent on an agent or an antibody, and thus increase the coupling efficiency. An increase in chemical reactivity may also facilitate the use of agents, or functional groups on agents,  
25 which otherwise would not be possible.

It will be evident to those skilled in the art that a variety of bifunctional or polyfunctional reagents, both homo- and hetero-functional (such as those described in the catalog of the Pierce Chemical Co., Rockford, IL), may be employed as the linker group. Coupling may be effected, for example, through amino groups, carboxyl groups,  
30 sulfhydryl groups or oxidized carbohydrate residues. There are numerous references describing such methodology, *e.g.*, U.S. Patent No. 4,671,958, to Rodwell et al.

Where a therapeutic agent is more potent when free from the antibody portion of the immunoconjugates of the present invention, it may be desirable to use a linker group which is cleavable during or upon internalization into a cell. A number of  
35 different cleavable linker groups have been described. The mechanisms for the intracellular release of an agent from these linker groups include cleavage by reduction

of a disulfide bond (*e.g.*, U.S. Patent No. 4,489,710, to Spitler), by irradiation of a photolabile bond (*e.g.*, U.S. Patent No. 4,625,014, to Senter et al.), by hydrolysis of derivatized amino acid side chains (*e.g.*, U.S. Patent No. 4,638,045, to Kohn et al.), by serum complement-mediated hydrolysis (*e.g.*, U.S. Patent No. 4,671,958, to Rodwell et al.), and acid-catalyzed hydrolysis (*e.g.*, U.S. Patent No. 4,569,789, to Blattler et al.).

It may be desirable to couple more than one agent to an antibody. In one embodiment, multiple molecules of an agent are coupled to one antibody molecule. In another embodiment, more than one type of agent may be coupled to one antibody. Regardless of the particular embodiment, immunoconjugates with more than one agent may be prepared in a variety of ways. For example, more than one agent may be coupled directly to an antibody molecule, or linkers which provide multiple sites for attachment can be used. Alternatively, a carrier can be used.

A carrier may bear the agents in a variety of ways, including covalent bonding either directly or via a linker group. Suitable carriers include proteins such as albumins (*e.g.*, U.S. Patent No. 4,507,234, to Kato et al.), peptides and polysaccharides such as aminodextran (*e.g.*, U.S. Patent No. 4,699,784, to Shih et al.). A carrier may also bear an agent by noncovalent bonding or by encapsulation, such as within a liposome vesicle (*e.g.*, U.S. Patent Nos. 4,429,008 and 4,873,088). Carriers specific for radionuclide agents include radiohalogenated small molecules and chelating compounds. For example, U.S. Patent No. 4,735,792 discloses representative radiohalogenated small molecules and their synthesis. A radionuclide chelate may be formed from chelating compounds that include those containing nitrogen and sulfur atoms as the donor atoms for binding the metal, or metal oxide, radionuclide. For example, U.S. Patent No. 4,673,562, to Davison et al. discloses representative chelating compounds and their synthesis.

A variety of routes of administration for the antibodies and immunoconjugates may be used. Typically, administration will be intravenous, intramuscular, subcutaneous or in site-specific regions by appropriate methods. It will be evident that the precise dose of the antibody/immunoconjugate will vary depending upon the antibody used, the antigen density, and the rate of clearance of the antibody.

Antibodies may be used in diagnostic tests to detect the presence of *Chlamydia* antigens using assays similar to those detailed above and other techniques well known to those of skill in the art, thereby providing a method for detecting Chlamydial infection in a patient.

Diagnostic reagents of the present invention may also comprise DNA sequences encoding one or more of the above polypeptides, or one or more portions

thereof. For example, at least two oligonucleotide primers may be employed in a polymerase chain reaction (PCR) based assay to amplify *Chlamydia*-specific cDNA derived from a biological sample, wherein at least one of the oligonucleotide primers is specific for a DNA molecule encoding a polypeptide of the present invention. The presence of the amplified cDNA is then detected using techniques well known in the art, such as gel electrophoresis. Similarly, oligonucleotide probes specific for a DNA molecule encoding a polypeptide of the present invention may be used in a hybridization assay to detect the presence of an inventive polypeptide in a biological sample.

As used herein, the term "oligonucleotide primer/probe specific for a DNA molecule" means an oligonucleotide sequence that has at least about 80%, preferably at least about 90% and more preferably at least about 95%, identity to the DNA molecule in question. Oligonucleotide primers and/or probes which may be usefully employed in the inventive diagnostic methods preferably have at least about 10-40 nucleotides. In a preferred embodiment, the oligonucleotide primers comprise at least about 10 contiguous nucleotides of a DNA molecule encoding one of the polypeptides disclosed herein. Preferably, oligonucleotide probes for use in the inventive diagnostic methods comprise at least about 15 contiguous oligonucleotides of a DNA molecule encoding one of the polypeptides disclosed herein. Techniques for both PCR based assays and hybridization assays are well known in the art (see, for example, Mullis *et al. Ibid*; Ehrlich, *Ibid*). Primers or probes may thus be used to detect *Chlamydia*-specific sequences in biological samples. DNA probes or primers comprising oligonucleotide sequences described above may be used alone or in combination with each other.

The following Examples are offered by way of illustration and not by way of limitation.

## EXAMPLE 1

ISOLATION OF DNA SEQUENCES ENCODING *CHLAMYDIA* ANTIGENS

*Chlamydia* antigens of the present invention were isolated by expression cloning of a genomic DNA library of *Chlamydia trachomatis* LGV II essentially as described by Sanderson et al. (*J. Exp. Med.*, 1995, 182:1751-1757) and were shown to induce PBMC proliferation and IFN- $\gamma$  in an immunoreactive T cell line.

A *Chlamydia*-specific T cell line was generated by stimulating PBMCs from a normal donor with no history of chlamydial genital tract infection with elementary bodies of *Chlamydia trachomatis* LGV II. This T cell line, referred to as TCL-8, was found to recognize both *Chlamydia trachomatis* and *Chlamydia pneumonia* infected monocyte-derived dendritic cells.

A randomly sheared genomic library of *Chlamydia trachomatis* LGV II was constructed in Lambda ZAP (Stratagene, La Jolla, CA) and the amplified library plated out in 96 well microtiter plates at a density of 30 clones/well. Bacteria were induced to express recombinant protein in the presence of 2 mM IPTG for 3 h, then pelleted and resuspended in 200  $\mu$ l of RPMI 10% FBS. 10  $\mu$ l of the induced bacterial suspension was transferred to 96 well plates containing autologous monocyte-derived dendritic cells. After a 2 h incubation, dendritic cells were washed to remove free *E. coli* and *Chlamydia*-specific T cells were added. Positive *E. coli* pools were identified by determining IFN- $\gamma$  production and proliferation of the T cells in response to the pools.

Four positive pools were identified, which were broken down to yield four pure clones (referred to as 1-B1-66, 4-D7-28, 3-G3-10 and 10-C10-31), with insert sizes of 481 bp, 183 bp, 110 bp and 1400 bp, respectively. The determined DNA sequences for 1-B1-66, 4-D7-28, 3-G3-10 and 10-C10-31 are provided in SEQ ID NO: 1-4, respectively. Clone 1-B1-66 is approximately in region 536690 of the *C. trachomatis* genome (NCBI *C. trachomatis* database). Within clone 1-B1-66, an open reading frame (ORF) has been identified (nucleotides 115 - 375) that encodes a previously identified 9 kDa protein (Stephens, et al. Genbank Accession No. AE001320), the sequence of which is provided in SEQ ID NO: 5). Clone 4-D7-28 is a smaller region of the same ORF (amino acids 22-82 of 1-B1-66). Clone 3-G3-10 is approximately in region 74559 of the *C. trachomatis* genome. The insert is cloned in the antisense orientation with respect to its orientation in the genome. The clone 10-C10-31 contains an open reading frame that corresponds to a previously published sequence for S13 ribosomal protein from *Chlamydia trachomatis* (Gu, L. et al. *J. Bacteriology*, 177:2594-2601, 1995). The predicted protein sequences for 4-D7-28 and

10-C10-31 are provided in SEQ ID NO: 6 and 12, respectively. Predicted protein sequences for 3-G3-10 are provided in SEQ ID NO: 7-11.

In a related series of screening studies, an additional T cell line was used to screen the genomic DNA library of *Chlamydia trachomatis* LGV II described above.

5 A *Chlamydia*-specific T cell line (TCT-1) was derived from a patient with a chlamydial genital tract infection by stimulating patient PBMC with autologous monocyte-derived dendritic cells infected with elementary bodies of *Chlamydia trachomatis* LGV II. One clone, 4C9-18 (SEQ ID NO: 21), containing a 1256 bp insert, elicited a specific immune response, as measured by standard proliferation assays, from the *Chlamydia*-

10 specific T cell line TCT-1. Subsequent analysis revealed this clone to contain three known sequences: lipoamide dehydrogenase (Genbank Accession No. AE001326), disclosed in SEQ ID NO: 22; a hypothetical protein CT429 (Genbank Accession No. AE001316), disclosed in SEQ ID NO: 23; and part of an open reading frame of ubiquinone methyltransferase CT428 (Genbank Accession No. AE001316), disclosed in

15 SEQ ID NO: 24.

In further studies involving clone 4C9-18 (SEQ ID NO: 21), the full-length amino acid sequence for lipoamide dehydrogenase (SEQ ID NO: 22) from *C. trachomatis* (LGV II) was expressed in clone CtL2-LPDA-FL, as disclosed in SEQ ID NO: 90.

20 To further characterize the open reading frame containing the T cell stimulating epitope(s), a cDNA fragment containing nucleotides 1-695 of clone 4C9-18 with a cDNA sequence encoding a 6X-Histidine tag on the amino terminus was subcloned into the NdeI/EcoRI site of the pET17b vector (Novagen, Madison, WI), referred to as clone 4C9-18#2 BL21 pLysS (SEQ ID NO: 25, with the corresponding

25 amino acid sequence provided in SEQ ID NO: 26) and transformed into *E. coli*. Selective induction of the transformed *E. coli* with 2 mM IPTG for three hours resulted in the expression of a 26 kDa protein from clone 4C9-18#2 BL21 pLysS, as evidenced by standard Coomassie-stained SDS-PAGE. To determine the immunogenicity of the protein encoded by clone 4C9-18#2 BL21 pLysS, *E. coli* expressing the 26 kDa protein

30 were titrated onto  $1 \times 10^4$  monocyte-derived dendritic cells and incubated for two hours. The dendritic cell cultures were washed and  $2.5 \times 10^4$  T cells (TCT-1) added and allowed to incubate for an additional 72 hours, at which time the level of IFN- $\gamma$  in the culture supernatant was determined by ELISA. As shown in Fig. 1, the T-cell line TCT-1 was found to respond to induced cultures as measured by IFN-g, indicating a

35 *Chlamydia*-specific T-cell response against the lipoamide dehydrogenase sequence.

Similarly, the protein encoded by clone 4C9-18#2 BL21 pLysS was shown to stimulate the TCT-1 T-cell line by standard proliferation assays.

Subsequent studies to identify additional *Chlamydia trachomatis* antigens using the above-described CD4+ T-cell expression cloning technique yielded additional clones. The TCT-1 and TCL-8 *Chlamydia*-specific T-cell lines, as well as the TCP-21 T-cell line were utilized to screen the *Chlamydia trachomatis* LGVII genomic library. The TCP-21 T-cell line was derived from a patient having a humoral immune response to *Chlamydia pneumoniae*. The TCT-1 cell line identified 37 positive pools, the TCT-3 cell line identified 41 positive pools and the TCP-21 cell line identified 2 positive pools. The following clones were derived from 10 of these positive pools. Clone 11-A3-93 (SEQ ID NO: 64), identified by the TCP-21 cell line, is a 1339 bp genomic fragment sharing homology to the HAD superfamily (CT103). The second insert in the same clone shares homology with the fab I gene (CT104) present on the complementary strand. Clone 11-C12-91 (SEQ ID NO: 63), identified using the TCP-21 cell line, has a 269 bp insert that is part of the OMP2 gene (CT443) and shares homology with the 60 kDa cysteine rich outer membrane protein of *C. pneumoniae*.

Clone 11-G10-46, (SEQ ID NO: 62), identified using the TCT-3 cell line, contains a 688 bp insert that shares homology to the hypothetical protein CT610. Clone 11-G1-34, (SEQ ID NO: 61), identified using the TCT-3 cell line, has two partial open reading frames (ORF) with an insert size of 1215 bp. One ORF shares homology to the malate dehydrogenase gene (CT376), and the other ORF shares homology to the glycogen hydrolase gene (CT042). Clone 11-H3-68, (SEQ ID NO: 60), identified using the TCT-3 cell line, has two ORFs with a total insert size of 1180 bp. One partial ORF encodes the plasmid-encoded PGP6-D virulence protein while the second ORF is a complete ORF for the L1 ribosomal gene (CT318). Clone 11-H4-28, (SEQ ID NO: 59), identified using the TCT-3 cell line, has an insert size of 552 bp and is part of the ORF for the dnaK gene (CT396). Clone 12-B3-95, (SEQ ID NO: 58), identified using the TCT-1 cell line, has an insert size of 463 bp and is a part of the ORF for the lipoamide dehydrogenase gene (CT557). Clones 15-G1-89 and 12-B3-95 are identical, (SEQ ID NO: 55 and 58, respectively), identified using the TCT-1 cell line, has an insert size of 463 bp and is part of the ORF for the lipoamide dehydrogenase gene (CT557). Clone 12-G3-83, (SEQ ID NO: 57), identified using the TCT-1 cell line, has an insert size of 1537 bp and has part of the ORF for the hypothetical protein CT622.

Clone 23-G7-68, (SEQ ID NO: 79), identified using the TCT-3 cell line, contains a 950 bp insert and contains a small part of the L11 ribosomal ORF, the entire ORF for L1 ribosomal protein and a part of the ORF for L10 ribosomal protein. Clone



22-F8-91, (SEQ ID NO: 80), identified using the TCT-1 cell line, contains a 395 bp insert that contains a part of the pmpC ORF on the complementary strand of the clone. Clone 21-E8-95, (SEQ ID NO: 81), identified using the TCT-3 cell line, contains a 2,085 bp insert which contains part of CT613 ORF, the complete ORF for CT612, the complete ORF for CT611 and part of the ORF for CT610. Clone 19-F12-57, (SEQ ID NO: 82), identified using the TCT-3 cell line, contains a 405 bp insert which contains part of the CT 858 ORF and a small part of the recA ORF. Clone 19-F12-53, (SEQ ID NO: 83), identified using the TCT-3 cell line, contains a 379 bp insert that is part of the ORF for CT455 encoding glutamyl tRNA synthetase. Clone 19-A5-54, (SEQ ID NO: 84), identified using the TCT-3 cell line, contains a 715 bp insert that is part of the ORF3 (complementary strand of the clone) of the cryptic plasmid. Clone 17-E11-72, (SEQ ID NO: 85), identified using the TCT-1 cell line, contains a 476 bp insert that is part of the ORF for Opp\_2 and pmpD. The pmpD region of this clone is covered by the pmpD region of clone 15-H2-76. Clone 17-C1-77, (SEQ ID NO: 86), identified using the TCT-3 cell line, contains a 1551 bp insert that is part of the CT857 ORF, as well as part of the CT858 ORF. Clone 15-H2-76, (SEQ ID NO: 87), identified using the TCT-1 cell line, contains a 3,031 bp insert that contains a large part of the pmpD ORF, part of the CT089 ORF, as well as part of the ORF for SycE. Clone 15-A3-26, (SEQ ID NO: 88), contains a 976 bp insert that contains part of the ORF for CT858. Clone 17-G4-36, (SEQ ID NO: 267), identified using the TCT-10 cell line, contains a 680 bp insert that is in frame with beta-gal in the plasmid and shares homology to part of the ORF for DNA-directed RNA polymerase beta subunit (CT315 in SerD).

Several of the clones described above share homology to various polymorphic membrane proteins. The genomic sequence of *Chlamydia trachomatis* contains a family of nine polymorphic membrane protein genes, referred to as pmp. These genes are designated pmpA, pmpB, pmpC, pmpD, pmpE, pmpF, pmpG, pmpH and pmpI. Proteins expressed from these genes are believed to be of biological relevance in generating a protective immune response to a *Chlamydial* infection. In particular, pmpC, pmpD, pmpE and pmpI contain predictable signal peptides, suggesting they are outer membrane proteins, and therefore, potential immunological targets.

Based on the *Chlamydia trachomatis* LGVII serovar sequence, primer pairs were designed to PCR amplify the full-length fragments of pmpC, pmpD, pmpE, pmpG, pmpH and pmpI. The resulting fragments were subcloned into the DNA vaccine vector JA4304 or JAL, which is JA4304 with a modified linker (SmithKline Beecham, London, England). Specifically, PmpC was subcloned into the JAL vector using the 5'

oligo GAT AGG CGC GCC GCA ATC ATG AAA TTT ATG TCA GCT ACT GCT G and the 3' oligo CAG AAC GCG TTT AGA ATG TCA TAC GAG CAC CGC A, as provided in SEQ ID NO: 197 and 198, respectively. PCR amplification of the gene under conditions well known in the art and ligation into the 5' ASCI/3' MluI sites of the

5 JAL vector was completed after inserting the short nucleotide sequence GCAATC (SEQ ID NO: 199) upstream of the ATG to create a Kozak-like sequence. The resulting expression vector contained the full-length pmpC gene comprising 5325 nucleotides (SEQ ID NO: 173) containing the hypothetical signal sequence, which encodes a 187 kD protein (SEQ ID NO: 179). The pmpD gene was subcloned into the JA4304 vaccine

10 vector following PCR amplification of the gene using the following oligos: 5' oligo- TGC AAT CAT GAG TTC GCA GAA AGA TAT AAA AAG C (SEQ ID NO: 200) and 3' oligo- CAG AGC TAG CTT AAA AGA TCA ATC GCA ATC CAG TAT TC (SEQ ID NO: 201). The gene was ligated into the a 5' blunted HIII/3' MluI site of the JA4304 vaccine vector using standard techniques well known in the art. The CAATC

15 (SEQ ID NO: 202) was inserted upstream of the ATG to create a Kozak-like sequence. This clone is unique in that the last threonine of the HindIII site is missing due to the blunting procedure, as is the last glycine of the Kozak-like sequence. The insert, a 4593 nucleotide fragment (SEQ ID NO: 172) is the full-length gene for pmpD containing the hypothetical signal sequence, which encodes a 161 kD protein (SEQ ID NO: 178).

20 PmpE was subcloned into the JA4304 vector using the 5' oligo- TGC AAT CAT GAA AAA AGC GTT TTT CTT TTT C (SEQ ID NO: 203), and the 3' oligo- CAG AAC GCG TCT AGA ATC GCA GAG CAA TTT C (SEQ ID NO: 204). Following PCR amplification, the gene was ligated into the 5' blunted HIII/3' MluI site of JA4304. To facilitate this, a short nucleotide sequence, TGCAATC (SEQ ID NO: 293), was added

25 upstream of the initiation codon for creating a Kozak-like sequence and reconstituting the HindIII site. The insert is the full-length pmpE gene (SEQ ID NO: 171) containing the hypothetical signal sequence. The pmpE gene encodes a 105 kD protein (SEQ ID NO: 177). The pmpG gene was PCR amplified using the 5' oligo- GTG CAA TCA TGA TTC CTC AAG GAA TTT ACG (SEQ ID NO: 205), and the 3' oligo- CAG

30 AAC GCG TTT AGA ACC GGA CTT TAC TTC C (SEQ ID NO: 206) and subcloned into the JA4304 vector. Similar cloning strategies were followed for the pmpI and pmpK genes. In addition, primer pairs were designed to PCR amplify the full-length or overlapping fragments of the pmp genes, which were then subcloned for protein expression in the pET17b vector (Novagen, Madison, WI) and transfected into E. coli

35 BL21 pLysS for expression and subsequent purification utilizing the histidine-nickel chromatographic methodology provided by Novagen. Several of the genes encoding

the recombinant proteins, as described below, lack the native signal sequence to facilitate expression of the protein. Full-length protein expression of pmpC was accomplished through expression of two overlapping fragments, representing the amino and carboxy termini. Subcloning of the pmpC-amino terminal portion, which lacks the  
5 signal sequence, (SEQ ID NO: 187, with the corresponding amino acid sequence provided in SEQ ID NO: 195) used the 5' oligo- CAG ACA TAT GCA TCA CCA TCA CCA TCA CGA GGC GAG CTC GAT CCA AGA TC (SEQ ID NO: 207), and the 3' oligo- CAG AGG TAC CTC AGA TAG CAC TCT CTC CTA TTA AAG TAG G (SEQ ID NO: 208) into the 5' NdeI/3' KPN cloning site of the vector. The carboxy  
10 terminus portion of the gene, pmpC-carboxy terminal fragment (SEQ ID NO: 186, with the corresponding amino acid sequence provided in SEQ ID NO: 194), was subcloned into the 5' NheI/3' KPN cloning site of the expression vector using the following primers: 5' oligo- CAG AGC TAG CAT GCA TCA CCA TCA CCA TCA CGT TAA GAT TGA GAA CTT CTC TGG C (SEQ ID NO: 209), and 3' oligo- CAG AGG TAC  
15 CTT AGA ATG TCA TAC GAG CAC CGC AG (SEQ ID NO: 210). PmpD was also expressed as two overlapping proteins. The pmpD-amino terminal portion, which lacks the signal sequence, (SEQ ID NO: 185, with the corresponding amino acid sequence provided in SEQ ID NO: 193) contains the initiating codon of the pET17b and is expressed as a 80 kD protein. For protein expression and purification purposes, a six-  
20 histidine tag follows the initiation codon and is fused at the 28<sup>th</sup> amino acid (nucleotide 84) of the gene. The following primers were used, 5' oligo, CAG ACA TAT GCA TCA CCA TCA CCA TCA CGG GTT AGC (SEQ ID NO: 211), and the 3' oligo- CAG AGG TAC CTC AGC TCC TCC AGC ACA CTC TCT TC (SEQ ID NO: 212), to splice into the 5' NdeI/3' KPN cloning site of the vector. The pmpD-carboxy terminus  
25 portion (SEQ ID NO: 184) was expressed as a 92 kD protein (SEQ ID NO: 192). For expression and subsequent purification, an additional methionine, alanine and serine was included, which represent the initiation codon and the first two amino acids from the pET17b vector. A six-histidine tag downstream of the methionine, alanine and serine is fused at the 691<sup>st</sup> amino acid (nucleotide 2073) of the gene. The 5' oligo- CAG  
30 AGC TAG CCA TCA CCA TCA CCA TCA CGG TGC TAT TTC TTG CTT ACG TGG (SEQ ID NO: 213) and the 3' oligo- CAG AGG TAC TTn AAA AGA TCA ATC GCA ATC CAG TAT TCG (SEQ ID NO: 214) were used to subclone the insert into the 5' NheI/3' KPN cloning site of the expression vector. PmpE was expressed as a 106kD protein (SEQ ID NO: 183 with the corresponding amino acid sequence provided in SEQ  
35 ID NO: 191). The pmpE insert also lacks the native signal sequence. PCR amplification of the gene under conditions well known in the art was performed using

the following oligo primers: 5' oligo- CAG AGG ATC CAC ATC ACC ATC ACC ATC ACG GAC TAG CTA GAG AGG TTC (SEQ ID NO: 215), and the 3' oligo- CAG AGA ATT CCT AGA ATC GCA GAG CAA TTT C (SEQ ID NO: 216), and the amplified insert was ligated into a 5' BamHI/3' EcoRI site of JA4304. The short  
5 nucleotide sequence, as provided in SEQ ID NO: 217, was inserted upstream of the initiation codon for creating the Kozak-like sequence and reconstituting the HindIII site. The expressed protein contains the initiation codon and the downstream 21 amino acids from the pET17b expression vector, i.e., MASMTGGQQMGRDSSLVPSSDP (SEQ ID NO: 218). In addition, a six-histidine tag is included upstream of the sequence  
10 described above and is fused at the 28<sup>th</sup> amino acid (nucleotide 84) of the gene, which eliminates the hypothetical signal peptide. The sequences provided in SEQ ID NO: 183 with the corresponding amino acid sequence provided in SEQ ID NO: 191 do not include these additional sequences. The *pmpG* gene (SEQ ID NO: 182, with the corresponding amino acid sequence provided in SEQ ID No; 190) was PCR amplified  
15 under conditions well known in the art using the following oligo primers: 5' oligo- CAG AGG TAC CGC ATC ACC ATC ACC ATC ACA TGA TTC CTC AAG GAA TTT ACG (SEQ ID NO: 219), and the 3' oligo- CAG AGC GGC CGC TTA GAA CCG GAC TTT ACT TCC (SEQ ID NO: 220), and ligated into the 5' KPN/3' NotI cloning site of the expression vector. The expressed protein contains an additional  
20 amino acid sequence at the amino end, namely, MASMTGGQQNGRDSSLVPHHHHHH (SEQ ID NO: 221), which comprises the initiation codon and additional sequence from the pET17b expression vector. The *pmpI* gene (SEQ ID NO: 181, with the corresponding amino acid sequence provided in SEQ ID No; 189) was PCR amplified under conditions well known in the art using the  
25 following oligo primers: 5' oligo- CAG AGC TAG CCA TCA CCA TCA CCA TCA CCT CTT TGG CCA GGA TCC C (SEQ ID NO: 222), and the 3' oligo- CAG AAC TAG TCT AGA ACC TGT AAG TGG TCC (SEQ ID NO: 223), and ligated into the expression vector at the 5' NheI/3' SpeI cloning site. The 95 kD expressed protein contains the initiation codon plus an additional alanine and serine from the pET17b  
30 vector at the amino end of the protein. In addition, a six-histidine tag is fused at the 21<sup>st</sup> amino acid of the gene, which eliminates the hypothetical signal peptide.

Clone 14H1-4, (SEQ ID NO: 56), identified using the TCT-3 cell line, contains a complete ORF for the TSA gene, thiol specific antioxidant – CT603 (the CT603 ORF is a homolog of CPn0778 from *C. pneumoniae*). The TSA open reading  
35 frame in clone 14-H1-4 was amplified such that the expressed protein possess an additional methionine and a 6x histidine tag (amino terminal end). This amplified insert

was sub-cloned into the Nde/EcoRI sites of the pET17b vector. Upon induction of this clone with IPTG, a 22.6 kDa protein was purified by Ni-NTA agarose affinity chromatography. The determined amino acid sequence for the 195 amino acid ORF of clone 14-H1-4 encoding the TSA gene is provided in SEQ ID NO: 65. Further analysis  
 5 yielded a full-length clone for the TSA gene, referred to as CTL2-TSA-FL, with the full-length amino acid sequence provided in SEQ ID NO: 92.

Further studies yielded 10 additional clones identified by the TCT-1 and TCT-3 T-cell lines, as described above. The clones identified by the TCT-1 line are: 16-D4-22, 17-C5-19, 18-C5-2, 20-G3-45 and 21-C7-66; clones identified by the TCT-3  
 10 cell line are: 17-C10-31, 17-E2-9, 22-A1-49 and 22-B3-53. Clone 21-G12-60 was recognized by both the TCT-1 and TCT-3 T cell lines. Clone 16-D4-22 (SEQ ID NO: 119), identified using the TCT-1 cell line contains a 953 bp insert that contains two genes, parts of open reading frame 3 (ORF3) and ORF4 of the *C. trachomatis* plasmid for growth within mammalian cells. Clone 17-C5-19 (SEQ ID NO: 118), contains a  
 15 951 bp insert that contains part of the ORF for DT431, encoding for clpP\_1 protease and part of the ORF for CT430 (diaminopimelate epimerase). Clone 18-C5-2 (SEQ ID NO: 117) is part of the ORF for S1 ribosomal protein with a 446 bp insert that was identified using the TCT-1 cell line. Clone 20-G3-45 (SEQ ID NO: 116), identified by the TCT-1 cell line, contains a 437 bp insert that is part of the pmpB gene (CT413).  
 20 Clone 21-C7-66 (SEQ ID NO: 115), identified by the TCT-1 line, contains a 995bp insert that encodes part of the dnaK like protein. The insert of this clone does not overlap with the insert of the TCT-3 clone 11-H4-28 (SEQ ID NO: 59), which was shown to be part of the dnaK gene CT396. Clone 17-C10-31 (SEQ ID NO: 114), identified by the TCT-3 cell line, contains a 976 bp insert. This clone contains part of  
 25 the ORF for CT858, a protease containing IRBP and DHR domains. Clone 17-E2-9 (SEQ ID NO: 113) contains part of ORFs for two genes, CT611 and CT610, that span a 1142 bp insert. Clone 22-A1-49 (SEQ ID NO: 112), identified using the TCT-3 line, also contains two genes in a 698 bp insert. Part of the ORF for CT660 (DNA gyrase{gyrA\_2}) is present on the top strand where as the complete ORF for a  
 30 hypothetical protein CT659 is present on the complementary strand. Clone 22-B3-53 (SEQ ID NO: 111), identified by the TCT-1 line, has a 267 bp insert that encodes part of the ORF for GroEL (CT110). Clone 21-G12-60 (SEQ ID NO: 110), identified by both the TCT-1 and TCT-3 cell lines contains a 1461 bp insert that contains partial ORFs for hypothetical proteins CT875, CT229 and CT228.

35 Additional *Chlamydia* antigens were obtained by screening a genomic expression library of *Chlamydia trachomatis* (LGV II serovar) in Lambda Screen-1

vector (Novagen, Madison, WI) with sera pooled from several *Chlamydia*-infected individuals using techniques well known in the art. The following immuno-reactive clones were identified and the inserts containing *Chlamydia* genes sequenced: CTL2#1 (SEQ ID NO: 71); CTL2#2 (SEQ ID NO: 70); CTL2#3-5' (SEQ ID NO: 72, a first  
 5 determined genomic sequence representing the 5' end); CTL2#3-3' (SEQ ID NO: 73, a second determined genomic sequence representing the 3' end); CTL2#4 (SEQ ID NO: 53); CTL2#5 (SEQ ID NO: 69); CTL2#6 (SEQ ID NO: 68); CTL2#7 (SEQ ID NO: 67); CTL2#8b (SEQ ID NO: 54); CTL2#9 (SEQ ID NO: 66); CTL2#10-5' (SEQ ID NO: 74, a first determined genomic sequence representing the 5' end); CTL2#10-3' (SEQ ID  
 10 NO: 75, a second determined genomic sequence representing the 3' end); CTL2#11-5' (SEQ ID NO: 45, a first determined genomic sequence representing the 5' end); CTL2#11-3' (SEQ ID NO: 44, a second determined genomic sequence representing the 3' end); CTL2#12 (SEQ ID NO: 46); CTL2#16-5' (SEQ ID NO: 47); CTL2#18-5' (SEQ ID NO: 49, a first determined genomic sequence representing the 5' end);  
 15 CTL2#18-3' (SEQ ID NO: 48, a second determined genomic sequence representing the 3' end); CTL2#19-5' (SEQ ID NO: 76, the determined genomic sequence representing the 5' end); CTL2#21 (SEQ ID NO: 50); CTL2#23 (SEQ ID NO: 51; and CTL2#24 (SEQ ID NO: 52).

Additional *Chlamydia trachomatis* antigens were identified by  
 20 serological expression cloning. These studies used sera pooled from several *Chlamydia*-infected individuals, as described above, but, IgA, and IgM antibodies were used in addition to IgG as a secondary antibody. Clones screened by this method enhance detection of antigens recognized by an early immune response to a *Chlamydial* infection, that is a mucosal humoral immune response. The following immunoreactive  
 25 clones were characterized and the inserts containing *Chlamydia* genes sequenced: CTL2gam-1 (SEQ ID NO: 290), CTL2gam-2 (SEQ ID NO: 289), CTL2gam-5 (SEQ ID NO: 288), CTL2gam-6-3' (SEQ ID NO: 287, a second determined genomic sequence representing the 3' end), CTL2gam-6-5' (SEQ ID NO: 286, a first determined genomic sequence representing the 5' end), CTL2gam-8 (SEQ ID NO: 285), CTL2gam-10 (SEQ  
 30 ID NO: 284), CTL2gam-13 (SEQ ID NO: 283), CTL2gam-15-3' (SEQ ID NO: 282, a second determined genomic sequence representing the 3' end), CTL2gam-15-5' (SEQ ID NO: 281, a first determined genomic sequence representing the 5' end), CTL2gam-17 (SEQ ID NO: 280), CTL2gam-18 (SEQ ID NO: 279), CTL2gam-21 (SEQ ID NO: 278), CTL2gam-23 (SEQ ID NO: 277), CTL2gam-24 (SEQ ID NO: 276), CTL2gam-26  
 35 (SEQ ID NO: 275), CTL2gam-27 (SEQ ID NO: 274), CTL2gam-28 (SEQ ID NO: 273), CTL2gam-30-3' (SEQ ID NO: 272, a second determined genomic sequence

representing the 3' end) and CTL2gam-30-5' (SEQ ID NO: 271, a first determined genomic sequence representing the 5' end).

## EXAMPLE 2

### 5 INDUCTION OF T CELL PROLIFERATION AND INTERFERON- $\gamma$ PRODUCTION BY *CHLAMYDIA TRACHOMATIS* ANTIGENS

The ability of recombinant *Chlamydia trachomatis* antigens to induce T cell proliferation and interferon- $\gamma$  production is determined as follows.

Proteins are induced by IPTG and purified by Ni-NTA agarose affinity  
10 chromatograph (Webb et al., *J. Immunology* 157:5034-5041, 1996). The purified polypeptides are then screened for the ability to induce T-cell proliferation in PBMC preparations. PBMCs from *C. trachomatis* patients as well as from normal donors whose T-cells are known to proliferate in response to *Chlamydia* antigens, are cultured in medium comprising RPMI 1640 supplemented with 10% pooled human serum and  
15 50  $\mu$ g/ml gentamicin. Purified polypeptides are added in duplicate at concentrations of 0.5 to 10  $\mu$ g/mL. After six days of culture in 96-well round-bottom plates in a volume of 200  $\mu$ l, 50  $\mu$ l of medium is removed from each well for determination of IFN- $\gamma$  levels, as described below. The plates are then pulsed with 1  $\mu$ Ci/well of tritiated thymidine for a further 18 hours, harvested and tritium uptake determined using a gas  
20 scintillation counter. Fractions that result in proliferation in both replicates three fold greater than the proliferation observed in cells cultured in medium alone are considered positive.

IFN- $\gamma$  is measured using an enzyme-linked immunosorbent assay (ELISA). ELISA plates are coated with a mouse monoclonal antibody directed to  
25 human IFN- $\gamma$  (PharMingen, San Diego, CA) in PBS for four hours at room temperature. Wells are then blocked with PBS containing 5% (W/V) non-fat dried milk for 1 hour at room temperature. The plates are washed six times in PBS/0.2% TWEEN-20 and samples diluted 1:2 in culture medium in the ELISA plates are incubated overnight at room temperature. The plates are again washed and a polyclonal rabbit anti-human  
30 IFN- $\gamma$  serum diluted 1:3000 in PBS/10% normal goat serum is added to each well. The plates are then incubated for two hours at room temperature, washed and horseradish peroxidase-coupled anti-rabbit IgG (Sigma Chemical So., St. Louis, MO) is added at a 1:2000 dilution in PBS/5% non-fat dried milk. After a further two hour incubation at room temperature, the plates are washed and TMB substrate added. The reaction is  
35 stopped after 20 min with 1 N sulfuric acid. Optical density is determined at 450 nm using 570 nm as a reference wavelength. Fractions that result in both replicates giving

an OD two fold greater than the mean OD from cells cultured in medium alone, plus 3 standard deviations, are considered positive.

Using the above methodology, recombinant 1B1-66 protein (SEQ ID NO: 5) as well as two synthetic peptides corresponding to amino acid residues 48-67 (SEQ ID NO: 13; referred to as 1-B1-66/48-67) and 58-77 (SEQ ID NO: 14, referred to as 1B1-66/58-77), respectively, of SEQ ID NO: 5, were found to induce a proliferative response and IFN- $\gamma$  production in a Chlamydia-specific T cell line used to screen a genomic library of *C. trachomatis* LGV II.

Further studies have identified a *C. trachomatis*-specific T-cell epitope in the ribosomal S13 protein. Employing standard epitope mapping techniques well known in the art, two T-cell epitopes in the ribosomal S13 protein (rS13) were identified with a *Chlamydia*-specific T-cell line from donor CL-8 (T-cell line TCL-8 EB/DC). Fig. 8 illustrates that the first peptide, rS13 1-20 (SEQ ID NO: 106), is 100% identical with the corresponding *C. pneumoniae* sequence, explaining the cross-reactivity of the T-cell line to recombinant *C. trachomatis*- and *C. pneumoniae*-rS13. The response to the second peptide rS13 56-75 (SEQ ID NO: 108) is *C. trachomatis*-specific, indicating that the rS13 response in this healthy asymptomatic donor was elicited by exposure to *C. trachomatis* and not to *C. pneumoniae*, or any other microbial infection.

As described in Example 1, Clone 11-C12-91 (SEQ ID NO: 63), identified using the TCP-21 cell line, has a 269 bp insert that is part of the OMP2 gene (CT443) and shares homology with the 60 kDa cysteine rich outer membrane protein of *C. pneumoniae*, referred to as OMCB. To further define the reactive epitope(s), epitope mapping was performed using a series of overlapping peptides and the immunoassay previously described. Briefly, proliferative responses were determined by stimulating  $2.5 \times 10^4$  TCP-21 T-cells in the presence of  $1 \times 10^4$  monocyte-derived dendritic cells with either non-infectious elementary bodies derived from *C. trachomatis* and *C. pneumoniae*, or peptides derived from the protein sequence of *C. trachomatis* or *C. pneumoniae* OMCB protein (0.1  $\mu$ g/ml). The TCP-21 T-cells responded to epitopes CT-OMCB #167-186, CT-OMCB #171-190, CT-OMCB #171-186, and to a lesser extent, CT-OMCB #175-186 (SEQ ID NO: 249-252, respectively). Notably, the TCP-21 T-cell line also gave a proliferative response to the homologous *C. pneumoniae* peptide CP-OMCB #171-186 (SEQ ID NO: 253), which was equal to or greater than the response to the *C. trachomatis* peptides. The amino acid substitutions in position two (i.e., Asp for Glu) and position four (i.e., Cys for Ser) did not alter the proliferative



response of the T-cells and therefore demonstrating this epitope to be a cross-reactive epitope between *C. trachomatis* and *C. pneumoniae*.

To further define the epitope described above, an additional T-cell line, TCT-3, was used in epitope mapping experiments. The immunoassays were performed  
5 as described above, except that only peptides from *C. trachomatis* were tested. The T-cells gave a proliferative response to two peptides, CT-OMCB #152-171 and CT-OMCB #157-176 (SEQ ID NO: 246 and 247, respectively), thereby defining an additional immunogenic epitope in the cysteine rich outer membrane protein of *C. trachomatis*.

10 Clone 14H1-4, (SEQ ID NO: 56, with the corresponding full-length amino acid sequence provided in SEQ ID NO: 92), was identified using the TCT-3 cell line in the CD4 T-cell expression cloning system previously described, and was shown to contain a complete ORF for the, thiol specific antioxidant gene (CT603), referred to as TSA. Epitope mapping immunoassays were performed, as described above, to  
15 further define the epitope. The TCT-3 T-cells line exhibited a strong proliferative response to the overlapping peptides CT-TSA #96-115, CT-TSA #101-120 and CT-TSA #106-125 (SEQ ID NO: 254-256, respectively) demonstrating an immunoreactive epitope in the thiol specific antioxidant gene of *C. trachomatis* serovar LGVII.

20

### EXAMPLE 3

#### PREPARATION OF SYNTHETIC POLYPEPTIDES

Polypeptides may be synthesized on a Millipore 9050 peptide synthesizer using Fmoc chemistry with HPTU (O-Benzotriazole-N,N,N',N'-tetramethyluronium hexafluorophosphate) activation. A Gly-Cys-Gly sequence may be  
25 attached to the amino terminus of the peptide to provide a method of conjugating or labeling of the peptide. Cleavage of the peptides from the solid support may be carried out using the following cleavage mixture: trifluoroacetic acid:ethanedithiol:thioanisole:water:phenol (40:1:2:2:3). After cleaving for 2 hours, the peptides may be precipitated in cold methyl-t-butyl-ether. The peptide pellets may then  
30 be dissolved in water containing 0.1% trifluoroacetic acid (TFA) and lyophilized prior to purification by C18 reverse phase HPLC. A gradient of 0-60% acetonitrile (containing 0.1% TFA) in water (containing 0.1% TFA) may be used to elute the peptides. Following lyophilization of the pure fractions, the peptides may be characterized using electrospray mass spectrometry and by amino acid analysis.

## EXAMPLE 4

ISOLATION AND CHARACTERIZATION OF DNA SEQUENCES ENCODING  
*CHLAMYDIA* ANTIGENS USING RETROVIRAL EXPRESSION VECTOR SYSTEMS

## 5 AND SUBSEQUENT IMMUNOLOGICAL ANALYSIS

A genomic library of *Chlamydia trachomatis* LGV II was constructed by limited digests using BamHI, BglII, BstYI and MboI restriction enzymes. The restriction digest fragments were subsequently ligated into the BamHI site of the retroviral vectors pBIB-KS1,2,3. This vector set was modified to contain a Kosak  
10 translation initiation site and stop codons in order to allow expression of proteins from short DNA genomic fragments, as shown in Fig. 2. DNA pools of 80 clones were prepared and transfected into the retroviral packaging line Phoenix-Ampho, as described in Pear, W.S., Scott, M.L. and Nolan, G.P., Generation of High Titre, Helper-free Retroviruses by Transient Transfection. Methods in Molecular Medicine: Gene  
15 Therapy Protocols, Humana Press, Totowa, NJ, pp. 41-57. The *Chlamydia* library in retroviral form was then transduced into H2-Ld expressing P815 cells, which were then used as target cells to stimulate an antigen specific T-cell line.

A *Chlamydia*-specific, murine H2<sup>d</sup> restricted CD8<sup>+</sup> T-cell line was expanded in culture by repeated rounds of stimulation with irradiated *C. trachomatis*-  
20 infected J774 cells and irradiated syngeneic spleen cells, as described by Starnbach, M., in *J. Immunol.*, 153:5183, 1994. This *Chlamydia*-specific T-cell line was used to screen the above *Chlamydia* genomic library expressed by the retrovirally-transduced P815 cells. Positive DNA pools were identified by detection of IFN- $\gamma$  production using Elispot analysis (see Lalvani et al., *J. Experimental Medicine* 186:859-865, 1997).

25 Two positive pools, referred to as 2C7 and 2E10, were identified by IFN- $\gamma$  Elispot assays. Stable transductants of P815 cells from pool 2C7 were cloned by limiting dilution and individual clones were selected based upon their capacity to elicit IFN- $\gamma$  production from the *Chlamydia*-specific CTL line. From this screening process, four positive clones were selected, referred to as 2C7-8, 2C7-9, 2C7-19 and 2C7-21.  
30 Similarly, the positive pool 2E10 was further screened, resulting in an additional positive clone, which contains three inserts. The three inserts are fragments of the CT016, tRNA syntase and clpX genes (SEQ ID NO: 268-270, respectively).

Transgenic DNA from these four positive 2C7 clones were PCR amplified using pBIB-KS specific primers to selectively amplify the *Chlamydia* DNA  
35 insert. Amplified inserts were gel purified and sequenced. One immunoreactive clone, 2C7-8 (SEQ ID NO: 15, with the predicted amino acid sequence provided in SEQ ID

NO: 32), is a 160 bp fragment with homology to nucleotides 597304-597145 of *Chlamydia trachomatis*, serovar D (NCBI, BLASTN search; SEQ ID NO: 33, with the predicted amino acid sequence provided in SEQ ID NO: 34). The sequence of clone 2C7-8 maps within two putative open reading frames from the region of high homology described immediately above, and in particular, one of these putative open reading frames, consisting of a 298 amino acid fragment (SEQ ID NO: 16, with the predicted amino acid sequence provided in SEQ ID NO: 17), was demonstrated to exhibit immunological activity.

Full-length cloning of the 298 amino acid fragment (referred to as CT529 and/or the Cap1 gene) from serovar L2 was obtained by PCR amplification using 5'-ttttgaagcaggtaggtgaatatg (forward) (SEQ ID NO: 159) and 5'-ttaagaaatttaaaaaatccctta (reverse) (SEQ ID NO: 160) primers, using purified *C. trachomatis* L2 genomic DNA as template. This PCR product was gel-purified, cloned into pCRBlunt (Invitrogen, Carlsbad, CA) for sequencing, and then subcloned into the *EcoRI* site of pBIB-KMS, a derivative of pBIB-KS for expression. The *Chlamydia pneumoniae* homologue of CT529 is provided in SEQ ID NO: 291, with the corresponding amino acid sequence provided in SEQ ID NO: 292.

Full-length DNA encoding various CT529 serovars were amplified by PCR from bacterial lysates containing  $10^5$  IFU, essentially as described (Denamur, E., C. Sayada, A. Souriau, J. Orfila, A. Rodolakis and J. Elion. 1991. J. Gen. Microbiol. 137: 2525). The following serovars were amplified as described: Ba (SEQ ID NO: 134, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 135); E (BOUR) and E (MTW447) (SEQ ID NO: 122, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 123); F (NI1) (SEQ ID NO: 128, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 129); G; (SEQ ID NO: 126, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 127); Ia (SEQ ID NO: 124, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 125); L1 (SEQ ID NO: 130, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 131); L3 (SEQ ID NO: 132, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 133); I (SEQ ID NO: 263, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 264); K (SEQ ID NO: 265, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 266); and MoPn (SEQ ID NO: 136, with the corresponding predicted amino acid sequence provided in SEQ ID NO: 137). PCR reactions were performed with Advantage Genomic PCR Kit (Clontech, Palo Alto, CA) using primers specific for serovar L2 DNA (external to the ORF). Primers sequences were 5'-

ggataatatctctctaaatttg (forward-SEQ ID NO: 161) and 5'-agataaaaaaggctgtttc' (reverse-SEQ ID NO: 162) except for MoPn which required 5'-tttgaagcaggtaggatgaatg (forward-SEQ ID NO: 163) and 5'-ttacaataagaaaagctaagcactttgt (reverse-SEQ ID NO: 164). PCR amplified DNA was purified with QIAquick PCR purification kit (Qiagen, Valencia, CA) and cloned in pCR2.1 (Invitrogen, Carlsbad, CA) for sequencing.

Sequencing of DNA derived from PCR amplified inserts of immunoreactive clones was done on an automated sequencer (ABI 377) using both a pBIB-KS specific forward primer 5'-ccttacacagtctctgac (SEQ ID NO: 165) and a reverse primer 3'-gtttccgggccctcacattg (SEQ ID NO: 166). PCRBlunt cloned DNA coding for CT529 serovar L2 and pCR2.1 cloned DNA coding for CT529 serovar Ba, E (BOUR), E (MTW447), F (NI1), G, Ia, K, L1, L3 and MoPn were sequenced using T7 promoter primer and universal M13 forward and M13 reverse primers.

To determine if these two putative open reading frames (SEQ ID NO: 16 and 20) encoded a protein with an associated immunological function, overlapping peptides (17-20 amino acid lengths) spanning the lengths of the two open reading frames were synthesized, as described in Example 3. A standard chromium release assay was utilized to determine the per cent specific lysis of peptide-pulsed H2<sup>d</sup> restricted target cells. In this assay, aliquots of P815 cells (H2<sup>d</sup>) were labeled at 37° C for one hour with 100 µCi of <sup>51</sup>Cr in the presence or absence of 1 µg/ml of the indicated peptides. Following this incubation, labeled P815 cells were washed to remove excess <sup>51</sup>Cr and peptide, and subsequently plated in duplicate in microculture plates at a concentration of 1,000 cells/well. Effector CTL (*Chlamydia*-specific CD8 T cells) were added at the indicated effector:target ratios. Following a 4 hour incubation, supernatants were harvested and measured by gamma-counter for release of <sup>51</sup>Cr into the supernatant. Two overlapping peptides from the 298 amino acid open reading frame did specifically stimulate the CTL line. The peptides represented in SEQ ID NO: 138-156 were synthesized, representing the translation of the L2 homologue of the serovar D open reading frame for CT529 (Cap1 gene) and 216 amino acid open reading frame. As shown in Fig. 3, peptides CtC7.8-12 (SEQ ID NO: 18, also referred to as Cap1#132-147, SEQ ID NO: 139) and CtC7.8-13 (SEQ ID NO: 19, also referred to as Cap1#138-155, SEQ ID NO: 140) were able to elicit 38 to 52% specific lysis, respectively, at an effector to target ratio of 10:1. Notably, the overlap between these two peptides contained a predicted H2<sup>d</sup> (K<sup>d</sup> and L<sup>d</sup>) binding peptide. A 10 amino acid peptide was synthesized to correspond to this overlapping sequence (SEQ ID NO: 31) and was found to generate a strong immune response from the anti-*Chlamydia* CTL line by elispot assay. Significantly, a search of the most recent Genbank database revealed no

proteins have previously been described for this gene. Therefore, the putative open reading frame encoding clone 2C7-8 (SEQ ID NO: 15) defines a gene which encompasses an antigen from *Chlamydia* capable of stimulating antigen-specific CD8+ T-cells in a MHC-I restricted manner, demonstrating this antigen could be used to  
5 develop a vaccine against *Chlamydia*.

To confirm these results and to further map the epitope, truncated peptides (SEQ ID NO: 138-156) were made and tested for recognition by the T-cells in an IFN- $\gamma$  ELISPOT assay. Truncations of either Ser139 (Cap1#140-147, SEQ ID NO: 146) or Leu147 (Cap1#138-146, SEQ ID NO: 147) abrogate T-cell recognition. These  
10 results indicate that the 9-mer peptide Cap1#139-147 (SFIGGITYL, SEQ ID NO: 145) is the minimal epitope recognized by the *Chlamydia*-specific T-cells.

Sequence alignments of Cap1 (CT529) from selected serovars of *C. trachomatis* (SEQ ID NO: 121, 123, 125, 127, 129, 131, 133, 135, 137 and 139) shows one of the amino acid differences is found in position 2 of the proposed epitope. The  
15 homologous serovar D peptide is SIIGGITYL (SEQ ID NO: 168). The ability of SFIGGITYL and SIIGGITYL to target cells for recognition by the *Chlamydia* specific T-cells was compared. Serial dilutions of each peptide were incubated with P815 cells and tested for recognition by the T-cells in a  $^{51}\text{Cr}$  release assay, as described above. The *Chlamydia*-specific T-cells recognize the serovar L2 peptide at a minimum  
20 concentration of 1 nM and the serovar D peptide at a minimum concentration of 10 nM.

Further studies have shown that a Cap1#139-147-specific T-cell clone recognizes *C. trachomatis* infected cells. To confirm that Cap1<sub>139-147</sub> is presented on the surface of *Chlamydia* infected cells, Balb-3T3 (H-2<sup>d</sup>) cells were infected with *C. trachomatis* serovar L2 and tested to determine whether these cells are recognized by a  
25 CD8+ T-cell clone specific for Cap1#139-147 epitope (SEQ ID NO: 145). The T-cell clone specific for Cap1#139-147 epitope was obtained by limiting dilution of the line 69 T-cells. The T-cell clone specifically recognized the *Chlamydia* infected cells. In these experiments, target cells were *C. trachomatis* infected (positive control) or uninfected Balb/3T3 cells, showing 45%, 36% and 30% specific lysis at 30:1, 10:1 and  
30 3:1 effector to target ratios, respectively; or Cap1#139-147 epitope (SEQ ID NO: 145) coated, or untreated P815 cells, showing 83%, 75% and 58% specific lysis at 30:1, 10:1 and 3:1 effector to target ratios, respectively (negative controls having less than 5% lysis in all cases). This data suggests that the epitope is presented during infection.

In vivo studies show Cap1#139-147 epitope-specific T-cells are primed  
35 during murine infection with *C. trachomatis*. To determine if infection with *C. trachomatis* primes a Cap1#139-147 epitope-specific T-cell response, mice were

infected i.p. with  $10^8$  IFU of *C. trachomatis* serovar L2. Two weeks after infection, the mice were sacrificed and spleen cells were stimulated on irradiated syngeneic spleen cells pulsed with Cap1#139-147 epitope peptide. After 5 days of stimulation, the cultures were used in a standard  $^{51}\text{Cr}$  release assay to determine if there were Cap1#139-147 epitope-specific T-cells present in the culture. Specifically, spleen cells from a *C. trachomatis* serovar L2 immunized mouse or a control mouse injected with PBS after a 5 days culture with Cap1#139-147 peptide-coated syngeneic spleen cells and CD8+ T-cells able to specifically recognize Cap1#139-147 epitope gave 73%, 60% and 32% specific lysis at 30:1, 10:1 and 3:1 effector to target ratios, respectively. The control mice had a percent lysis of approximately 10% at a 30:1 effector to target ratio, and steadily declining with lowering E:T ratios. Target cells were Cap1#139-147 peptide-coated, or untreated P815 cells. These data suggest that Cap1#139-147 peptide-specific T-cells are primed during murine infection with *C. trachomatis*.

Studies were performed demonstrating that Ct529 (referred to herein as Cap-1) localizes to the inclusion membrane of *C. trachomatis*-infected cells and is not associated with elementary bodies or reticulate bodies. As described above, Cap-1 was identified as a product from *Chlamydia* that stimulates CD8+ CTL. These CTL are protective in a murine model of infection, thus making Cap-1 a good vaccine candidate. Further, since these CTL are MHC-I restricted, the Cap-1 gene must have access to the cytosol of infected cells, which may be a unique characteristic of specific *Chlamydial* gene products. Therefore, determination of the cellular localization of the gene products would be useful in characterizing Cap-1 as a vaccine candidate. To detect the intracellular localization of Cap-1, rabbit polyclonal antibodies directed against a recombinant polypeptide encompassing the N-terminal 125 amino acids of Cap-1 (SEQ ID NO: 305, with the amino acid sequence including the N-terminal 6-His tag provided in SEQ ID NO: 304) were used to stain McCoy cells infected with *Chlamydiae*.

Rabbit-anti-Cap-1 polyclonal antibodies were obtained by hyperimmunization of rabbits with a recombinant polypeptide, rCt529c1-125 (SEQ ID NO: 305) encompassing the N-terminal portion of Cap-1. Recombinant rCt529e1-125 protein was obtained from *E. coli* transformed with a pET expression plasmid (as described above) encoding the nucleotides 1-375 encoding the N-terminal 1-125 amino acids of Cap-1. Recombinant protein was purified by Ni-NTA using techniques well known in the art. For a positive control antiserum, polyclonal antisera directed against elementary bodies were made by immunization of rabbits with purified *C. trachomatis* elementary bodies (Biodesign, Sacco, Maine). Pre-immune sera derived from rabbits prior to immunization with the Cap-1 polypeptide was used as a negative control.

Immunocytochemistry was performed on McCoy cell monolayers grown on glass coverslips inoculated with either *C. trachomatis* serovar L2 or *C. psittaci*, strain 6BC, at a concentration of  $10^6$  IFU (Inclusion Forming Units) per ml. After 2 hours, medium was aspirated and replaced with fresh RP-10 medium supplemented with cycloheximide (1.0  $\mu$ g/ml). Infected cells were incubated at in 7% CO<sub>2</sub> for 24 hours and fixed by aspirating medium, rinsing cells once with PBS and methanol fixation for 5 minutes. For antigen staining, fixed cell monolayers were washed with PBS and incubated at 37°C for 2 hours with 1:100 dilutions of specific or control antisera. Cells were rinsed with PBS and incubated for 1 hour with fluorescein isothiocyanate (FITC)-labeled, anti-rabbit IgG (KPL, Gaithersburg) and stained with Evans blue (0.05%) in PBS. Fluorescence was observed with a 100X objective (Zeiss epifluorescence microscope), and photographed (Nikon UFX-11A camera).

Results from this study show Cap-1 localizes to the inclusion membrane of *C. trachomatis*-infected cells. Cap-1 specific antibody labeled the inclusion membranes of *C. trachomatis*-infected cells, but not *Chlamydial* elementary bodies contained in these inclusions or released by the fixation process. Conversely, the anti-elementary body antibody clearly labeled the bacterial bodies, not only within the inclusions, but those released by the fixation process. Specificity of the anti-Cap-1 antibody is demonstrated by the fact that it does not stain *C. psittaci*-infected cells. Specificity of the Cap-1 labeling is also shown by the absence of reactivity in pre-immune sera. These results suggest that Cap-1 is released from the bacteria and becomes associated with the *Chlamydial* inclusion membrane. Therefore, Cap-1 is a gene product which may be useful for stimulating CD8+ T cells in the development of a vaccine against infections caused by *Chlamydia*.

The relevance of the Cap-1 gene as a potential CTL antigen in a vaccine against *Chlamydia* infection is further illustrated by two additional series of studies. First, CTL specific for the MHC-I epitope of Cap-1 CT529 #138-147 peptide of *C. trachomatis* (SEQ ID NO: 144) have been shown to be primed to a high frequency during natural infection. Specifically, Balb/C mice were inoculated with  $10^6$  I.F.U. of *C. trachomatis*, serova L2. After 2 weeks, spleens were harvested and quantified by Elispot analysis for the number of IFN- $\gamma$  secreting cells in response to Cap-1 #138-147 peptide-pulsed antigen presenting cells. In two experiments, the number of IFN- $\gamma$ -secreting cells in  $10^5$  splenocytes was about 1% of all CD8+ T-cells. This high frequency of responding CD8+ CTL to the MHC-1 epitope (Cap-1 CT529 #138-147 peptide) suggest that Cap-1 is highly immunogenic in infections.

Results from a second series of studies have shown that the Cap-1 protein is almost immediately accessible to the cytosol of the host cell upon infection. This is shown in a time-course of Cap-1 CT529 #138-147 peptide presentation. Briefly, 3T3 cells were infected with *C. trachomatis* serovar L2 for various lengths of time, and then tested for recognition by Cap-1 CT529 #138-147 peptide-specific CTL. The results show that *C. trachomatis*-infected 3T3 cells are targeted for recognition by the antigen-specific CTL after only 2 hours of infection. These results suggest that Cap-1 is an early protein synthesized in the development of *C. trachomatis* elementary bodies to reticulate bodies. A CD8+ CTL immune response directed against a gene product expressed early in infection may be particularly efficacious in a vaccine against *Chlamydia* infection.

#### EXAMPLE 5

##### GENERATION OF ANTIBODY AND T-CELL RESPONSES IN MICE IMMUNIZED WITH *CHLAMYDIA* ANTIGENS

Immunogenicity studies were conducted to determine the antibody and CD4+ T cell responses in mice immunized with either purified SWIB or S13 proteins formulated with Montanide adjuvant, or DNA-based immunizations with pcDNA-3 expression vectors containing the DNA sequences for SWIB or S13. SWIB is also referred to as clone 1-B1-66 (SEQ ID NO: 1, with the corresponding amino acid sequence provided in SEQ ID NO: 5), and S13 ribosomal protein is also referred to as clone 10-C10-31 (SEQ ID NO: 4, with the corresponding amino acid sequence provided in SEQ ID NO: 12). In the first experiment, groups of three C57BL/6 mice were immunized twice and monitored for antibody and CD4+ T-cell responses. DNA immunizations were intradermal at the base of the tail and polypeptide immunizations were administered by subcutaneous route. Results from standard <sup>3</sup>H-incorporation assays of spleen cells from immunized mice shows a strong proliferative response from the group immunized with purified recombinant SWIB polypeptide (SEQ ID NO: 5). Further analysis by cytokine induction assays, as previously described, demonstrated that the group immunized with SWIB polypeptide produced a measurable IFN- $\gamma$  and IL-4 response. Subsequent ELISA-based assays to determine the predominant antibody isotype response in the experimental group immunized with the SWIB polypeptide were performed. Fig. 4 illustrates the SWIB-immunized group gave a humoral response that was predominantly IgG1.

In a second experiment, C3H mice were immunized three times with 10  $\mu$ g purified SWIB protein (also referred to as clone 1-B1-66, SEQ ID NO: 5)



formulated in either PBS or Montanide at three week intervals and harvested two weeks after the third immunization. Antibody titers directed against the SWIB protein were determined by standard ELISA-based techniques well known in the art, demonstrating the SWIB protein formulated with Montanide adjuvant induced a strong humoral immune response. T-cell proliferative responses were determined by a XTT-based assay (Scudiero, et al, *Cancer Research*, 1988, 48:4827). As shown in Fig. 5, splenocytes from mice immunized with the SWIB polypeptide plus Montanide elicited an antigen specific proliferative response. In addition, the capacity of splenocytes from immunized animals to secrete IFN- $\gamma$  in response to soluble recombinant SWIB polypeptide was determined using the cytokine induction assay previously described. The splenocytes from all animals in the group immunized with SWIB polypeptide formulated with montanide adjuvant secreted IFN- $\gamma$  in response to exposure to the SWIB Chlamydia antigen, demonstrating an *Chlamydia*-specific immune response.

In a further experiment, C3H mice were immunized at three separate time points at the base of the tail with 10  $\mu$ g of purified SWIB or S13 protein (*C. trachomatis*, SWIB protein, clone 1-B1-66, SEQ ID NO: 5, and S13 protein, clone 10-C10-31, SEQ ID NO: 4) formulated with the SBAS2 adjuvant (SmithKline Beecham, London, England). Antigen-specific antibody titers were measured by ELISA, showing both polypeptides induced a strong IgG response, ranging in titers from  $1 \times 10^4$  to  $1 \times 10^5$ . The IgG1 and IgG2a components of this response were present in fairly equal amounts. Antigen-specific T-cell proliferative responses, determined by standard  $^3$ H-incorporation assays on spleen cells isolated from immunized mice, were quite strong for SWIB (50,000 cpm above the negative control) and even stronger for s13 (100,000 cpm above the negative control). The IFN $\gamma$  production was assayed by standard ELISA techniques from supernatant from the proliferating culture. *In vitro* restimulation of the culture with S13 protein induced high levels of IFN $\gamma$  production, approximately 25 ng/ml versus 2 ng/ml for the negative control. Restimulation with the SWIB protein also induced IFN $\gamma$ , although to a lesser extent.

In a related experiment, C3H mice were immunized at three separate time points with 10  $\mu$ g of purified SWIB or S13 protein (*C. trachomatis*, SWIB protein, clone 1-B1-66, SEQ ID NO: 5, and S13 protein, clone 10-C10-31, SEQ ID NO: 4) mixed with 10  $\mu$ g of Cholera Toxin. Mucosal immunization was through intranasal inoculation. Antigen-specific antibody responses were determined by standard ELISA techniques. Antigen-specific IgG antibodies were present in the blood of SWIB-immunized mice, with titers ranging from  $1 \times 10^3$  to  $1 \times 10^4$ , but non-detectable in the S13-immunized animals. Antigen-specific T-cell responses from isolated splenocytes,

as measured by IFN $\gamma$  production, gave similar results to those described immediately above for systemic immunization.

An animal study was conducted to determine the immunogenicity of the CT529 serovar LGVII CTL epitope, defined by the CT529 10mer consensus peptide (CSFIGGITYL – SEQ ID NO: 31), which was identified as an H2-Kd restricted CTL epitope. BALB/c mice (3 mice per group) were immunized three times with 25  $\mu$ g of peptide combined with various adjuvants. The peptide was administered systemically at the base of the tail in either SKB Adjuvant System SBAS-2", SBAS-7 (SmithKline Beecham, London, England) or Montanide. The peptide was also administered intranasally mixed with 10ug of Cholera Toxin (CT). Naive mice were used as a control. Four weeks after the 3rd immunization, spleen cells were restimulated with LPS-blasts pulsed with 10ug/ml CT529 10mer consensus peptide at three different effector to LPS-blasts ratios : 6, 1.5 and 0.4 at  $1 \times 10^6$  cell/ml. After 2 restimulations, effector cells were tested for their ability to lyse peptide pulsed P815 cells using a standard chromium release assay. A non-relevant peptide from chicken egg ovalbumin was used as a negative control. The results demonstrate that a significant immune response was elicited towards the CT529 10mer consensus peptide and that antigen-specific T-cells capable of lysing peptide-pulsed targets were elicited in response to immunization with the peptide. Specifically, antigen-specific lytic activities were found in the SBAS-7 and CT adjuvanted group while Montanide and SBAS-2" failed to adjuvant the CTL epitope immunization.

#### EXAMPLE 6

##### EXPRESSION AND CHARACTERIZATION OF *CHLAMYDIA PNEUMONIAE* GENES

The human T-cell line, TCL-8, described in Example 1, recognizes *Chlamydia trachomatis* as well as *Chlamydia pneumonia* infected monocyte-derived dendritic cells, suggesting *Chlamydia trachomatis* and *pneumonia* may encode cross-reactive T-cell epitopes. To isolate the *Chlamydia pneumonia* genes homologous to *Chlamydia trachomatis* LGV II clones 1B1-66, also referred to as SWIB (SEQ ID NO: 1) and clone 10C10-31, also referred to as S13 ribosomal protein (SEQ ID NO: 4), HeLa 229 cells were infected with *C. pneumonia* strain TWAR (CDC/CWL-029). After three days incubation, the *C. pneumonia*-infected HeLa cells were harvested, washed and resuspended in 200  $\mu$ l water and heated in a boiling water bath for 20 minutes. Ten microliters of the disrupted cell suspension was used as the PCR template.

*C. pneumonia* specific primers were designed for clones 1B1-66 and 10C10-31 such that the 5' end had a 6X-Histidine tag and a Nde I site inserted, and the

3' end had a stop codon and a BamHI site included (Fig. 6). The PCR products were amplified and sequenced by standard techniques well known in the art. The *C. pneumonia*-specific PCR products were cloned into expression vector pET17B (Novagen, Madison, WI) and transfected into *E. coli* BL21 pLysS for expression and subsequent purification utilizing the histidine-nickel chromatographic methodology provided by Novagen. Two proteins from *C. pneumonia* were thus generated, a 10-11 kDa protein referred to as CpSWIB (SEQ ID NO: 27, and SEQ ID NO: 78 having a 6X His tag, with the corresponding amino acid sequence provided in SEQ ID NO: 28, respectively), a 15 kDa protein referred to as CpS13 (SEQ ID NO: 29, and SEQ ID NO: 77, having a 6X His tag, with the corresponding amino acid sequence provided in SEQ ID NO: 30 and 91, respectively).

#### EXAMPLE 7

##### INDUCTION OF T CELL PROLIFERATION AND INTERFERON- $\gamma$ PRODUCTION BY *CHLAMYDIA PNEUMONIAE* ANTIGENS

The ability of recombinant *Chlamydia pneumoniae* antigens to induce T cell proliferation and interferon- $\gamma$  production is determined as follows.

Proteins are induced by IPTG and purified by Ni-NTA agarose affinity chromatography (Webb et al., *J. Immunology* 157:5034-5041, 1996). The purified polypeptides are then screened for the ability to induce T-cell proliferation in PBMC preparations. PBMCs from *C. pneumoniae* patients as well as from normal donors whose T-cells are known to proliferate in response to *Chlamydia* antigens, are cultured in medium comprising RPMI 1640 supplemented with 10% pooled human serum and 50  $\mu$ g/ml gentamicin. Purified polypeptides are added in duplicate at concentrations of 0.5 to 10  $\mu$ g/mL. After six days of culture in 96-well round-bottom plates in a volume of 200  $\mu$ l, 50  $\mu$ l of medium is removed from each well for determination of IFN- $\gamma$  levels, as described below. The plates are then pulsed with 1  $\mu$ Ci/well of tritiated thymidine for a further 18 hours, harvested and tritium uptake determined using a gas scintillation counter. Fractions that result in proliferation in both replicates three fold greater than the proliferation observed in cells cultured in medium alone are considered positive.

IFN- $\gamma$  was measured using an enzyme-linked immunosorbent assay (ELISA). ELISA plates are coated with a mouse monoclonal antibody directed to human IFN- $\gamma$  (PharMingen, San Diego, CA) in PBS for four hours at room temperature. Wells are then blocked with PBS containing 5% (W/V) non-fat dried milk for 1 hour at room temperature. The plates are washed six times in PBS/0.2% TWEEN-20 and samples diluted 1:2 in culture medium in the ELISA plates are incubated overnight at

room temperature. The plates are again washed and a polyclonal rabbit anti-human IFN- $\gamma$  serum diluted 1:3000 in PBS/10% normal goat serum is added to each well. The plates are then incubated for two hours at room temperature, washed and horseradish peroxidase-coupled anti-rabbit IgG (Sigma Chemical So., St. Louis, MO) is added at a  
5 1:2000 dilution in PBS/5% non-fat dried milk. After a further two hour incubation at room temperature, the plates are washed and TMB substrate added. The reaction is stopped after 20 min with 1 N sulfuric acid. Optical density is determined at 450 nm using 570 nm as a reference wavelength. Fractions that result in both replicates giving an OD two fold greater than the mean OD from cells cultured in medium alone, plus 3  
10 standard deviations, are considered positive.

A human anti-*Chlamydia* T-cell line (TCL-8) capable of cross-reacting to *C. trachomatis* and *C. pneumonia* was used to determine whether the expressed proteins described in the example above, (i.e., CpSWIB, SEQ ID NO: 27, and SEQ ID NO: 78 having a 6X His tag, with the corresponding amino acid sequence provided in  
15 SEQ ID NO: 28, respectively, and the 15 kDa protein referred to as CpS13 SEQ ID NO: 29, and SEQ ID NO: 77, having a 6X His tag, with the corresponding amino acid sequence provided in SEQ ID NO: 30 and 91, respectively), possessed T-cell epitopes common to both *C. trachomatis* and *C. pneumonia*. Briefly, *E. coli* expressing *Chlamydial* proteins were titred on  $1 \times 10^4$  monocyte-derived dendritic cells. After  
20 two hours, the dendritic cells cultures were washed and  $2.5 \times 10^4$  T cells (TCL-8) added and allowed to incubate for an additional 72 hours. The amount of IFN- $\gamma$  in the culture supernatant was then determined by ELISA. As shown in Figs. 7A and 7B, the TCL-8 T-cell line specifically recognized the S13 ribosomal protein from both *C. trachomatis* and *C. pneumonia* as demonstrated by the antigen-specific induction of IFN- $\gamma$ , whereas  
25 only the SWIB protein from *C. trachomatis* was recognized by the T-cell line. To validate these results, the T cell epitope of *C. trachomatis* SWIB was identified by epitope mapping using target cells pulsed with a series of overlapping peptides and the T-cell line TCL-8. 3H-thymidine incorporation assays demonstrated that the peptide, referred to as C.t.SWIB 52-67, of SEQ ID NO: 39 gave the strongest proliferation of the  
30 TCL-8 line. The homologous peptides corresponding to the SWIB of *C. pneumoniae* sequence (SEQ ID NO: 40), the topoisomerase-SWIB fusion of *C. pneumoniae* (SEQ ID NO: 43) and *C. trachomatis* (SEQ ID NO: 42) as well as the human SWI domain (SEQ ID NO: 41) were synthesized and tested in the above assay. The T-cell line TCL-8 only recognized the *C. trachomatis* peptide of SEQ ID NO: 39 and not the  
35 corresponding *C. pneumoniae* peptide (SEQ ID NO: 40), or the other corresponding peptides described above (SEQ ID NO: 41-43).

Chlamydia-specific T cell lines were generated from donor CP-21 with a positive serum titer against *C. pneumoniae* by stimulating donor PBMC with either *C. trachomatis* or *C. pneumoniae*-infected monocyte-derived dendritic cells, respectively. T-cells generated against *C. pneumoniae* responded to recombinant *C. pneumoniae*-SWIB but not *C. trachomatis*-SWIB, whereas the T-cell line generated against *C. trachomatis* did not respond to either *C. trachomatis*- or *C. pneumoniae*-SWIB (see Fig. 9). The *C. pneumoniae*-SWIB specific immune response of donor CP-21 confirms the *C. pneumoniae* infection and indicates the elicitation of *C. pneumoniae*-SWIB specific T-cells during *in vivo* *C. pneumoniae* infection.

Epitope mapping of the T-cell response to *C. pneumoniae*-SWIB has shown that Cp-SWIB-specific T-cells responded to the overlapping peptides Cp-SWIB 32-51 (SEQ ID NO: 101) and Cp-SWIB 37-56 (SEQ ID NO: 102), indicating a *C. pneumoniae*-SWIB-specific T-cell epitope Cp-SWIB 37-51 (SEQ ID NO: 100).

In additional experiments, T-cell lines were generated from donor CP1, also a *C. pneumoniae* seropositive donor, by stimulating PBMC with non-infectious elementary bodies from *C. trachomatis* and *C. pneumoniae*, respectively. In particular, proliferative responses were determined by stimulating  $2.5 \times 10^4$  T-cells in the presence of  $1 \times 10^4$  monocyte-derived dendritic cells and non-infectious elementary bodies derived from *C. trachomatis* and *C. pneumoniae*, or either recombinant *C. trachomatis* or *C. pneumoniae* SWIB protein. The T-cell response against SWIB resembled the data obtained with T-cell lines from CP-21 in that *C. pneumoniae*-SWIB, but not *C. trachomatis*-SWIB elicited a response by the *C. pneumoniae* T-cell line. In addition, the *C. trachomatis* T-cell line did not proliferate in response to either *C. trachomatis* or *C. pneumoniae* SWIB, though it did proliferate in response to both CT and CP elementary bodies. As described in Example 1, Clone 11-C12-91 (SEQ ID NO: 63), identified using the TCP-21 cell line, has a 269 bp insert that is part of the OMP2 gene (CT443) and shares homology with the 60 kDa cysteine rich outer membrane protein of *C. pneumoniae*, referred to as OMCB. To further define the reactive epitope(s), epitope mapping was performed using a series of overlapping peptides and the immunoassay previously described. Briefly, proliferative responses were determined by stimulating  $2.5 \times 10^4$  TCP-21 T-cells in the presence of  $1 \times 10^4$  monocyte-derived dendritic cells with either non-infectious elementary bodies derived from *C. trachomatis* and *C. pneumoniae*, or peptides derived from the protein sequence of *C. trachomatis* or *C. pneumoniae* OMCB protein (0.1  $\mu$ g/ml). The TCP-21 T-cells responded to epitopes CT-OMCB #167-186, CT-OMCB #171-190, CT-OMCB #171-186, and to a lesser extent, CT-OMCB #175-186 (SEQ ID NO: 249-252, respectively). Notably, the TCP-

21 T-cell line also gave a proliferative response to the homologous *C. pneumoniae* peptide CP-OMCB #171-186 (SEQ ID NO: 253), which was equal to or greater than the response to the to the *C. trachomatis* peptides. The amino acid substitutions in position two (i.e., Asp for Glu) and position four (i.e., Cys for Ser) did not alter the proliferative  
5 response of the T-cells and therefore demonstrating this epitope to be a cross-reactive epitope between *C. trachomatis* and *C. pneumoniae*.

#### EXAMPLE 8

##### IMMUNE RESPONSES OF HUMAN PBMC AND T-CELL LINES

##### 10 AGAINST *CHLAMYDIA* ANTIGENS

The examples provided herein suggest that there is a population of healthy donors among the general population that have been infected with *C. trachomatis* and generated a protective immune response controlling the *C. trachomatis* infection. These donors remained clinically asymptomatic and seronegative for *C.*  
15 *trachomatis*. To characterize the immune responses of normal donors against *chlamydial* antigens which had been identified by CD4 expression cloning, PBMC obtained from 12 healthy donors were tested against a panel of recombinant *chlamydial* antigens including *C. trachomatis*-, *C. pneumoniae*-SWIB and *C. trachomatis*-, *C. pneumoniae*-S13. The data are summarized in Table I below. All donors were  
20 seronegative for *C. trachomatis*, whereas 6/12 had a positive *C. pneumoniae* titer. Using a stimulation index of >4 as a positive response, 11/12 of the subjects responded to *C. trachomatis* elementary bodies and 12/12 responded to *C. pneumoniae* elementary bodies. One donor, AD104, responded to recombinant *C. pneumoniae*-S13 protein, but not to recombinant *C. trachomatis*-S13 protein, indicating a *C. pneumoniae*-specific  
25 response. Three out of 12 donors had a *C. trachomatis*-SWIB, but not a *C. pneumoniae*-SWIB specific response, confirming a *C. trachomatis* infection. *C. trachomatis* and *C. pneumoniae*- S13 elicited a response in 8/12 donors suggesting a chlamydial infection. These data demonstrate the ability of SWIB and S13 to elicit a T-cell response in PBMC of normal study subjects.

TABLE I

Immune response of normal study subjects against *Chlamydia*

Donor	Sex	<i>Chlamydia</i> IgG titer	CT EB	CP EB	CT Swib	CP Swib	CT S13	CP S13	CT lpdA	CT TSA
AD100	male	negative	++	+++	+	-	++	++	-	n.t.
AD104	female	negative	+++	++	-	-	-	++	-	n.t.
AD108	male	CP 1:256	++	++	+	+/-	+	+	+	n.t.
AD112	female	negative	++	++	+	-	+	-	+/-	n.t.
AD120	male	negative	-	+	-	-	-	-	-	n.t.
AD124	female	CP 1:128	++	++	-	-	-	-	-	n.t.
AD128	male	CP 1:512	+	++	-	-	++	+	++	-
AD132	female	negative	++	++	-	-	+	+	-	-
AD136	female	CP 1:128	+	++	-	-	+/-	-	-	-
AD140	male	CP 1:256	++	++	-	-	+	+	-	-
AD142	female	CP 1:512	++	++	-	-	+	+	+	-
AD146	female	negative	++	++	-	-	++	+	+	-

CT= *Chlamydia trachomatis*; CP= *Chlamydia pneumoniae*; EB= *Chlamydia* elementary  
5 bodies; Swib= recombinant *Chlamydia* Swib protein; S13= recombinant *Chlamydia*  
S13 protein; lpdA= recombinant *Chlamydia* lpdA protein; TSA= recombinant  
*Chlamydia* TSA protein. Values represent results from standard proliferation assays.  
Proliferative responses were determined by stimulating  $3 \times 10^5$  PBMC with  $1 \times 10^4$   
10 monocyte-derived dendritic cells pre-incubated with the respective recombinant  
antigens or elementary bodies (EB). Assays were harvested after 6 days with a  $^3\text{H}$ -  
thymidine pulse for the last 18h.

## SI: Stimulation index

	+/-:	SI ~	4
	+	SI >	4
	++:	SI	10-30
5	+++:	SI >	30

In a first series of experiments, T-cell lines were generated from a healthy female individual (CT-10) with a history of genital exposure to *C. trachomatis* by stimulating T-cells with *C. trachomatis* LGV II elementary bodies as previously described. Although the study subject was exposed to *C. trachomatis*, she did not seroconvert and did not develop clinical symptoms, suggesting donor CT-10 may have developed a protective immune response against *C. trachomatis*. As shown in Fig. 10, a primary *Chlamydia*-specific T-cell line derived from donor CT-10 responded to *C. trachomatis*-SWIB, but not *C. pneumoniae*-SWIB recombinant proteins, confirming the exposure of CT-10 to *C. trachomatis*. Epitope mapping of the T-cell response to *C. trachomatis*-SWIB showed that this donor responded to the same epitope Ct-SWIB 52-67 (SEQ ID NO: 39) as T-cell line TCL-8, as shown in Fig. 11.

Additional T-cell lines were generated as described above for various *C. trachomatis* patients. A summary of the patients' clinical profile and proliferative responses to various *C. trachomatis* and *C. pneumoniae* elementary bodies and recombinant proteins are summarized in Table II.



TABLE II

Proliferative response of <i>C. trachomatis</i> patients											
Patients	Clinical manifestation	IgG titer	CT EB	CP EB	CT Swib	CP Swib	CT S13	CP S13	CT lpdA	CT TSA	
CT-1	NGU	negative	+	+	-	-	++	++	++	+	
CT-2	NGU	negative	++	++	-	-	+	+/-	-	-	
CT-3	asymptomatic shed Eb Dx was HPV	Ct 1:512 Cp 1:1024 Cps 1:256	+	+	-	-	+	-	+	-	
CT-4	asymptomatic shed Eb	Ct 1:1024	+	+	-	-	-	-	-	-	
CT-5	BV	Ct 1:256 Cp 1:256	++	++	-	-	+	-	-	-	
CT-6	perinial rash discharge	Cp 1:1024	+	+	-	-	-	-	-	-	
CT-7	BV genital ulcer	Ct 1:512 Cp 1:1024	+	+	-	-	+	+	+	-	
CT-8	Not known	Not tested	++	++	-	-	-	-	-	-	
CT-9	asymptomatic	Ct 1:128 Cp 1:128	+++	++	-	-	++	+	+	-	
CT-10	Itch mild vulvar	negative	++	++	-	-	-	-	-	-	
CT-11	BV, abnormal pap	Ct 1: 512	+++	+++	-	-	+++	+/-	++	+	
CT-12	asymptomatic	Cp 1: 512	++	++	-	-	++	+	+	-	

NGU= Non-Gonococcal Urethritis; BV= Bacterial Vaginosis; CT= *Chlamydia trachomatis*; CP= *Chlamydia pneumoniae*; EB= *Chlamydia* elementary bodies; Swib= recombinant *Chlamydia* Swib protein; S13= recombinant *Chlamydia* S13 protein; lpdA= recombinant *Chlamydia* lpdA protein; TSA= recombinant *Chlamydia* TSA protein

Values represent results from standard proliferation assays. Proliferative responses were determined by stimulating  $3 \times 10^5$  PBMC with  $1 \times 10^4$  monocyte-

derived dendritic cells pre-incubated with the respective recombinant antigens or elementary bodies (EB). Assays were harvested after 6 days with a  $^3\text{H}$ -thymidine pulse for the last 18 hours.

5 SI: Stimulation index

+/-:	SI ~	4
+:	SI >	4
++:	SI	10-30
+++:	SI >	30

10

Using the panel of asymptomatic (as defined above) study subjects and *C. trachomatis* patients, as summarized in Tables I and II, a comprehensive study of the immune responses of PBMC derived from the two groups was conducted. Briefly, PBMCs from *C. pneumoniae* patients as well as from normal donors are cultured in  
 15 medium comprising RPMI 1640 supplemented with 10% pooled human serum and 50  $\mu\text{g/ml}$  gentamicin. Purified polypeptides, a panel of recombinant *chlamydial* antigens including *C. trachomatis*-, *C. pneumoniae*-SWIB and S13, as well as *C. trachomatis* lpdA and TSA are added in duplicate at concentrations of 0.5 to 10  $\mu\text{g/mL}$ . After six days of culture in 96-well round-bottom plates in a volume of 200  $\mu\text{l}$ , 50  $\mu\text{l}$  of medium  
 20 is removed from each well for determination of IFN- $\gamma$  levels, as described below. The plates are then pulsed with 1  $\mu\text{Ci/well}$  of tritiated thymidine for a further 18 hours, harvested and tritium uptake determined using a gas scintillation counter. Fractions that result in proliferation in both replicates three fold greater than the proliferation observed in cells cultured in medium alone are considered positive.

25 Proliferative responses to the recombinant *Chlamydiae* antigens demonstrated that the majority of asymptomatic donors and *C. trachomatis* patients recognized the *C. trachomatis* S13 antigen (8/12) and a majority of the *C. trachomatis* patients recognized the *C. pneumonia* S13 antigen (8/12), with 4/12 asymptomatic donors also recognizing the *C. pneumonia* S13 antigen. Also, six out of twelve of the  
 30 *C. trachomatis* patients and four out of twelve of the asymptomatic donors gave a proliferative response to the lpdA antigen of *C. trachomatis*. These results demonstrate that the *C. trachomatis* and *C. pneumonia* S13 antigen, *C. trachomatis* Swib antigen and the *C. trachomatis* lpdA antigen are recognized by the asymptomatic donors, indicating these antigens were recognized during exposure to *Chlamydia* and an  
 35 immune response elicited against them. This implies these antigens may play a role in conferring protective immunity in a human host. In addition, the *C. trachomatis* and *C. pneumonia* S13 antigen is recognized equally well among the *C. trachomatis* patients,

therefore indicating there may be epitopes shared between *C. trachomatis* and *C. pneumonia* in the S13 protein. Table III summarizes the results of these studies.

TABLE III

A. Antigen	NORMAL DONORS	C.T. PATIENTS
C.t.-Swib	3/12	0/12
C.p.-Swib	0/12	0/12
C.t.-S13	8/12	8/12
C.p.-S13	4/12	8/12
lpdA	4/12	6/12
TSA	0/12	2/12

5

A series of studies were initiated to determine the cellular immune response to short-term T-cell lines generated from asymptomatic donors and *C. trachomatis* patients. Cellular immune responses were measured by standard proliferation assays and IFN- $\gamma$ , as described in Example 7. Specifically, the majority of the antigens were in the form of single *E. coli* clones expressing Chlamydial antigens, although some recombinant proteins were also used in the assays. The single *E. coli* clones were titrated on  $1 \times 10^4$  monocyte-derived dendritic cells and after two hours, the culture was washed and  $2.5 \times 10^4$  T-cells were added. The assay using the recombinant proteins were performed as previously described. Proliferation was determined after four days with a standard  $^3\text{H}$ -thymidine pulse for the last 18 hours. Induction of IFN- $\gamma$  was determined from culture supernatants harvested after four days using standard ELISA assays, as described above. The results show that all the *C. trachomatis* antigens tested, except for C.T. Swib, elicited a proliferative response from one or more different T-cell lines derived from *C. trachomatis* patients. In addition, proliferative responses were elicited from both the *C. trachomatis* patients and asymptomatic donors for the following *Chlamydia* genes, CT622, groEL, pmpD, CT610 and rS13.

The 12G3-83 clone also contains sequences to CT734 and CT764 in addition to CT622, and therefore these gene sequence may also have immunoreactive epitopes. Similarly, clone 21G12-60 contains sequences to the hypothetical protein genes CT229 and CT228 in addition to CT875; and 15H2-76 also contains sequences

25

from CT812 and CT088, as well as sharing homology to the *sycE* gene. Clone 11H3-61 also contains sequences sharing homology to the PGP6-D virulence protein.

TABLE IV

Clone	C. t. Antigen (putative*)	TCL from Asymp. Donors	TCL from C. t. Patients	SEQ ID NO:
1B1-66 (E. coli)	Swib	2/2	0/4	5
1B1-66 (protein)	Swib	2/2	0/4	5
12G3-83 (E. coli)	CT622*	2/2	4/4	57
22B3-53 (E. coli)	GROEL	1/2	4/4	111
22B3-53 (protein)	GROEL	1/2	4/4	111
15H2-76 (E. coli)	PMPD*	1/2	3/4	87
11H3-61 (E. coli)	rL1*	0/2	3/4	60
14H1-4 (E. coli)	TSA	0/2	3/4	56
14H1-4 (protein)	TSA	0/2	3/4	56
11G10-46 (E. coli)	CT610	1/2	1/4	62
10C10-17 (E. coli)	rS13	1/2	1/4	62
10C10-17 (protein)	RS13	1/2	1/4	62
21G12-60 (E. coli)	CT875*	0/2	2/4	110
11H4-32 (E. coli)	DNAK	0/2	2/4	59
21C7-8 (E. coli)	DNAK	0/2	2/4	115
17C10-31 (E. coli)	CT858	0/2	2/4	114

5

## EXAMPLE 9

PROTECTION STUDIES USING *CHLAMYDIA* ANTIGENS

Protection studies were conducted in mice to determine whether immunization with chlamydial antigens can impact on the genital tract disease resulting from chlamydial inoculation. Two models were utilized; a model of intravaginal inoculation that uses a human isolate containing a strain of *Chlamydia psittaci* (MTW447), and a model of intrauterine inoculation that involves a human isolate identified as *Chlamydia trachomatis*, serovar F (strain NI1). Both strains induce inflammation in the upper genital tract, which resemble endometritis and salpingitis caused by *Chlamydia trachomatis* in women. In the first experiment, C3H mice (4

mice per group) were immunized three times with 100 µg of pcDNA-3 expression vector containing *C. trachomatis* SWIB DNA (SEQ ID NO: 1, with the corresponding amino acid sequence provided in SEQ ID NO: 5). Inoculations were at the base of the tail for systemic immunization. Two weeks after the last immunization, animals were  
5 progesterone treated and infected, either thru the vagina or by injection of the inoculum in the uterus. Two weeks after infection, the mice were sacrificed and genital tracts sectioned, stained and examined for histopathology. Inflammation level was scored (from + for very mild, to +++++ for very severe). Scores attributed to each single oviduct /ovary were summed and divided by the number of organs examined to get a  
10 mean score of inflammation for the group. In the model of uterine inoculation, negative control-immunized animals receiving empty vector showed consistent inflammation with an ovary /oviduct mean inflammation score of 6.12, in contrast to 2.62 for the DNA-immunized group. In the model of vaginal inoculation and ascending infection, negative control-immunized mice had an ovary /oviduct mean inflammation score of  
15 8.37, versus 5.00 for the DNA-immunized group. Also, in the later model, vaccinated mice showed no signs of tubal occlusion while negative control vaccinated groups had inflammatory cells in the lumen of the oviduct

In a second experiment, C3H mice (4 mice per group) were immunized three times with 50 µg of pcDNA-3 expression vector containing *C. trachomatis* SWIB  
20 DNA (SEQ ID NO: 1, with the corresponding amino acid sequence provided in SEQ ID NO: 5) encapsulated in Poly Lactide co-Glycolide microspheres (PLG); immunizations were made intra-peritoneally. Two weeks after the last immunization, animal were progesterone treated and infected by inoculation of *C. psittaci* in the vagina. Two weeks after infection, mice were sacrificed and genital tracts sectioned, stained and  
25 examined for histopathology. Inflammation level was scored as previously described. Scores attributed to each single oviduct /ovary were summed and divided by the number of examined organs to get a mean of inflammation for the group. Negative control-immunized animals receiving PLG-encapsulated empty vector showed consistent inflammation with an ovary /oviduct mean inflammation score of 7.28, versus 5.71 for  
30 the PLG-encapsulated DNA immunized group. Inflammation in the peritoneum was 1.75 for the vaccinated group versus 3.75 for the control.

In a third experiment, C3H mice (4 per group) were immunized three times with 10 µg of purified recombinant protein, either SWIB (SEQ ID NO: 1, with the corresponding amino acid sequence provided in SEQ ID NO: 5, or S13 (SEQ ID  
35 NO: 4, with the corresponding amino acid sequence provided in SEQ ID NO: 12) mixed with Cholera Toxin (CT); the preparation was administered intranasally upon anaesthesia

in a 20 uL volume. Two weeks after the last immunization, animal were progesterone treated and infected, either by vaginal inoculation of *C. psittaci* or by injection of *C. trachomatis* serovar F in the uterus. Two weeks after infection, the mice were sacrificed and genital tracts sectioned, stained and examined for histopathology. The degree of inflammation was scored as described above. Scores attributed to each single oviduct /ovary were summed and divided by the number of examined organs to get a mean score of inflammation for the group. In the model of uterine inoculation, negative control- immunized animals receiving cholera toxin alone showed an ovary /oviduct mean inflammation score of 4.25 (only 2 mice analyzed ; 2 other died) versus 5.00 for the s13 plus cholera toxin-immunized group, and 1.00 for the SWIB plus cholera toxin. Untreated infected animals had an ovary /oviduct mean inflammation score of 7. In the model of vaginal inoculation and ascending infection, negative control-immunized mice had an ovary /oviduct mean inflammation score of 7.37 versus 6.75 for the s13 plus cholera toxin-immunized group and 5.37 for the SWIB plus cholera toxin-immunized group. Untreated infected animals had an ovary /oviduct mean inflammation score of 8.

The three experiments described above suggest that SWIB-specific protection is obtainable. This protective effect is more marked in the model of homologous infection but is still present when in a heterologous challenge infection with *C. psittaci*.

20

#### EXAMPLE 10

##### PMP/RA12 FUSION PROTEINS

Various Pmp/Ra12 fusion constructs were generated by first synthesizing PCR fragments of a Pmp gene using primers containing a Not I restriction site. Each PCR fragment was then ligated into the NotI restriction site of pCRX1. The pCRX1 vector contains the 6HisRa12 portion of the fusion. The Ra12 portion of the fusion construct encodes a polypeptide corresponding to amino acid residues 192-323 of *Mycobacterium tuberculosis* MTB32A, as described in U.S. Patent Application 60/158,585, the disclosure of which is incorporated herein by reference. The correct orientation of each insert was determined by its restriction enzyme pattern and its sequence was verified. Multiple fusion constructs were made for PmpA, PmpB, PmpC, PmpF and PmpH, as described further below:

## PMPA FUSION PROTEINS

PmpA is 107 kD protein containing 982 aa and was cloned from serovar E. The PmpA protein was divided into 2 overlapping fragments, the PmpA(N-terminal) and (C-terminal) portions.

PmpA(N-term) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCATGTTTATAACAAAGGAACTTATG (SEQ ID NO:306)

GAGAGCGGCCGCTTACTTAGGTGAGAAGAAGGGAGTTTC (SEQ ID NO:307)

respectively. The resulting fusion construct has a DNA sequence set forth in SEQ ID NO: 308, encoding a 66 kD protein (619aa) expressing the segment 1-473 aa of PmpA. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 309.

PmpA(C-term) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCCATTCTATTCATTTCTTTGATCCTG (SEQ ID NO:310)

GAGAGCGGCCGCTTAGAAGCCAACATAGCCTCC (SEQ ID NO:311)

respectively. The resulting fusion construct has a DNA sequence set forth in SEQ ID NO: 312, encoding a 74 kD protein (691aa) expressing the segment 438-982 aa of PmpA. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 313.

## PMPF FUSION PROTEINS

PmpF is 112 kD protein containing 1034 aa and was cloned from the serovar E. PmpF protein was divided into 2 overlapping fragments, the PmpF(N-term) and (C-term) portions.

PmpF(N-term) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCATGATTAAAAGAACTTCTCTATCC (SEQ ID NO:314)

GAGAGCGGCCGCTTATAATTCTGCATCATCTTCTATGGC (SEQ ID NO:315)

respectively. The resulting fusion has a DNA sequence set forth in SEQ ID NO: 316, encoding a 69 kD protein (646aa) expressing the segment 1-499 aa of PmpF. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 317.

PmpF(C-term) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCGACATACGAACTCTGATGGG (SEQ ID NO:318)

5 GAGAGCGGCCGCTTAAAAGACCAGAGCTCCTCC (SEQ ID NO:319)

respectively. The resulting fusion has a DNA sequence set forth in SEQ ID NO: 320, encoding a 77 kD protein (715aa) expressing the segment 466-1034aa of PmpF. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 321.

10 PMPH FUSION PROTEINS

PmpH is 108 kD protein containing 1016 aa and was cloned from the serovar E. PmpH protein was divided into 2 overlapping fragments, the PmpH(N-term) and (C-term) portions.

PmpH(N-term) was amplified by the sense and antisense primers:

15 GAGAGCGGCCGCTCATGCCTTTTTCTTTGAGATCTAC (SEQ ID NO:322)

GAGAGCGGCCGCTTACACAGATCCATTACCGGACTG (SEQ ID NO:323)

20 respectively. The resulting fusion has a DNA sequence set forth in SEQ ID NO: 324, encoding a 64 kD protein (631aa) expressing the segment 1-484 aa of PmpH. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 325.

PmpH(C-term) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCGATCCTGTAGTACAAAATAATTCAGC (SEQ ID NO:326)

25 GAGAGCGGCCGCTTAAAAGATTCTATTCAAGCC (SEQ ID NO:327)

respectively. The resulting fusion construct has a DNA sequence set forth in SEQ ID NO: 328, encoding a 77 kD protein (715aa) expressing the segment 449-1016aa of PmpH. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 329.

30

PMPB FUSION PROTEINS

PmpB is 183 kD protein containing 1750 aa and was cloned from the serovar E. PmpB protein was divided into 4 overlapping fragments, PmpB(1), (2), (3) and (4).

35 PmpB(1) was amplified by the sense and antisense primers:



GAGAGCGGCCGCTCATGAAATGGCTGTCAGCTACTGCG (SEQ ID NO:330)

GAGAGCGGCCGCTTACTTAATGCGAATTTCTTCAAG (SEQ ID NO:331)

- 5 respectively. The resulting fusion has a DNA sequence set forth in SEQ ID NO: 332, and encodes a 53 kD protein (518aa) expressing the segment 1-372 aa of PmpB. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 333.

PmpB(2) was amplified by the sense and antisense primers:

10 GAGAGCGGCCGCTCGGTGACCTCTCAATTCAATCTTC (SEQ ID NO:334)

GAGAGCGGCCGCTTAGTTCTCTGTTACAGATAAGGAGAC (SEQ ID NO:335)

- 15 respectively. The resulting fusion has a DNA sequence set forth in SEQ ID NO: 336 and encodes a 60 kD protein (585aa) expressing the segment 330-767 aa of PmpB. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 337.

PmpB(3) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCGACCAACTGAATATCTCTGAGAAC (SEQ ID NO:338)

20 GAGCGGCCGCTTAAGAGACTACGTGGAGTTCTG (SEQ ID NO:339)

respectively. The resulting fusion has a DNA sequence set forth in SEQ ID NO: 340 encodes a 67 kD protein (654aa) expressing the segment 732-1236 aa of PmpB. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 341

PmpB(4) was amplified by the sense and antisense primers:

25 GAGAGCGGCCGCTCGGAATATTGTGTTCTCTTCTG (SEQ ID NO:342)

GAGAGCGGCCGCTTAGAAGATCATGCGAGCACCGC (SEQ ID NO:343)

- 30 respectively. The resulting fusion construct has a DNA sequence set forth in SEQ ID NO: 344 encodes a 76 kD protein (700aa) expressing the segment 1160-1750 of PmpB. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 345.

## PMPC FUSION PROTEINS

PmpC is 187 kD protein containing 1774 aa and was cloned from the serovar E/L2. PmpC protein was divided into 3 overlapping fragments, PmpC(1), (2) and (3).

PmpC(1) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCATGAAATTTATGTCAGCTACTGC (SEQ ID NO:346)

GAGAGCGGCCGCTTACCCTGTAATTCCAGTGATGGTC (SEQ ID NO:347)

respectively. The resulting fusion construct has a DNA sequence set forth in SEQ ID NO: 348 and encodes a 51 kD protein (487aa) expressing the segment 1-340 aa of PmpC. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 349.

PmpC(2) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCGATACACAAGTATCAGAATCACC (SEQ ID NO:350)

GAGAGCGGCCGCTTAAGAGGACGATGAGACACTCTCG (SEQ ID NO:351)

respectively. The resulting fusion construct has a DNA sequence set forth in SEQ ID NO: 352 and encodes a 60 kD protein (583aa) expressing the segment 305-741 aa of PmpC. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 353.

PmpC(3) was amplified by the sense and antisense primers:

GAGAGCGGCCGCTCGATCAATCTAACGAAAACACAGACG (SEQ ID NO:354)

GAGAGCGGCCGCTTAGACCAAAGCTCCATCAGCAAC (SEQ ID NO:355)

respectively. The resulting fusion construct has a DNA sequence set forth in SEQ ID NO: 356 and encodes a 70 kD protein (683aa) expressing the segment 714-1250 aa of PmpC. The amino acid sequence of the fusion protein is set forth in SEQ ID NO: 357.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, changes and modifications can be carried out without departing from the scope of the invention which is intended to be limited only by the scope of the appended claims.

## CLAIMS

1. An isolated polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said antigen comprises an amino acid sequence encoded by a polynucleotide sequence selected from the group consisting of: (a) sequences recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-290 ; (b) sequences complementary to a sequence of (a); and (c) polynucleotide sequences that hybridize to a sequence of (a) or (b) under moderately stringent conditions.
2. The polypeptide of claim 1 wherein the polypeptide comprises a sequence selected from the group consisting of SEQ ID NO: 175-180, 189-196, 264 and 266.
3. An isolated polynucleotide molecule comprising a nucleotide sequence encoding a polypeptide according to any one of claims 1 and 2.
4. A recombinant expression vector comprising a polynucleotide molecule according to claim 3.
5. A host cell transformed with an expression vector according to claim 4.
6. The host cell of claim 5 wherein the host cell is selected from the group consisting of *E. coli*, yeast and mammalian cells.
7. A fusion protein comprising a polypeptide according to any one of claims 1 and 2.
8. A fusion protein according to claim 7, wherein the fusion protein comprises an expression enhancer that increases expression of the fusion protein in a host cell transfected with a polynucleotide encoding the fusion protein.
9. A fusion protein according to claim 7, wherein the fusion protein comprises a T helper epitope that is not present within the polypeptide of claim 1.
10. A fusion protein according to claim 7, wherein the fusion protein comprises an affinity tag.

11. An isolated polynucleotide encoding a fusion protein according to claim 7.

12. An isolated monoclonal antibody, or antigen-binding fragment thereof, that specifically binds to a Chlamydia protein that comprises an amino acid sequence that is encoded by a polynucleotide sequence according to claim 1, or a complement of any of the foregoing polynucleotide sequences.

13. A pharmaceutical composition comprising a polypeptide according to claim 1, and a physiologically acceptable carrier.

14. A pharmaceutical composition comprising a polynucleotide molecule according to claim 3 and a physiologically acceptable carrier.

15. A pharmaceutical composition comprising a polypeptide and a physiologically acceptable carrier, wherein the polypeptide is encoded by polynucleotide molecule selected from the group consisting of: (a) sequences recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291; (b) sequences complementary to a sequence of (a); and (c) sequences that hybridize to a sequence of (a) or (b) under moderately stringent conditions.

16. A pharmaceutical composition comprising a polynucleotide molecule and a physiologically acceptable carrier, wherein the polynucleotide molecule comprises a sequence selected from the group consisting of: (a) sequences recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291; (b) sequences complementary to a sequence of (a); and (c) sequences that hybridize to a sequence of (a) or (b) under moderately stringent conditions.

17. A pharmaceutical composition comprising a physiologically acceptable carrier and at least one component selected from the group consisting of:

- (a) a fusion protein according to claim 7;
- (b) a polynucleotide according to claim 11; and
- (c) an antibody according to claim 12.

18. A vaccine comprising a polypeptide according to claim 1, and an immunostimulant.

19. A vaccine comprising a polynucleotide molecule according to claim 3 and an immunostimulant.

20. A vaccine comprising a polypeptide and an immunostimulant, wherein the polypeptide is encoded by a sequence selected from the group consisting of: (a) sequences recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291 ; (b) sequences complementary to a sequence of (a); and (c) sequences that hybridize to a sequence of (a) or (b) under moderately stringent conditions.

21. A vaccine comprising a DNA molecule and an immunostimulant, wherein the DNA molecule comprises a sequence selected from the group consisting of: (a) sequences recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291; (b) sequences complementary to a sequence of (a); and (c) sequences that hybridize to a sequence of (a) or (b) under moderately stringent conditions.

22. A vaccine comprising an immunostimulant and at least one component selected from the group consisting of:

- (a) a fusion protein according to claim 7;
- (b) a polynucleotide according to claim 11; and
- (c) an antibody according to claim 12.

23. The vaccine of any one of claims 18-22 wherein the immunostimulant is an adjuvant.

24. A method for inducing protective immunity in a patient, comprising administering to a patient a pharmaceutical composition according to any one of claims 13-17.

25. A method for inducing protective immunity in a patient, comprising administering to a patient a vaccine according to any one of claims 18-22.

26. An isolated polyclonal antibody, or antigen-binding fragment thereof, that specifically binds to a Chlamydia protein that comprises an amino acid sequence that is encoded by a polynucleotide sequence according to claim 1, or a complement of any of the foregoing polynucleotide sequences.

27. A method for detecting *Chlamydia* infection in a patient, comprising:
- (a) obtaining a biological sample from the patient;
  - (b) contacting the sample with a polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said antigen comprises an amino acid sequence encoded by a polynucleotide sequence selected from the group consisting of: (i) a sequence recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291. (ii) sequences complementary to a sequence of (i), and (c) polynucleotide sequences that hybridize to a sequence of (i) or (ii) under moderately stringent conditions; and
  - (c) detecting the presence of antibodies that bind to the polypeptide.
28. A method for detecting *Chlamydia* infection in a patient, comprising:
- (a) obtaining a biological sample from the patient;
  - (b) contacting the sample with a fusion protein comprising a polypeptide, the polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said antigen comprises an amino acid sequence encoded by a polynucleotide sequence selected from the group consisting of (i) a sequence recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291 (ii) sequences complementary to a sequence of (i), and (c) polynucleotide sequences that hybridize to a sequence of (i) or (ii) under moderately stringent conditions; and
  - (c) detecting the presence of antibodies that bind to the fusion protein.
29. The method of any one of claims 27 and 28 wherein the biological sample is selected from the group consisting of whole blood, serum, plasma, saliva, cerebrospinal fluid and urine.
30. A method for detecting *Chlamydia* infection in a biological sample, comprising:
- (a) contacting the sample with at least two oligonucleotide primers in a polymerase chain reaction, wherein at least one of the oligonucleotide primers is specific for a polynucleotide molecule comprising a sequence of SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291; and
  - (b) detecting in the sample a polynucleotide sequence that amplifies in the presence of the oligonucleotide primers, thereby detecting *Chlamydia* infection.

31. The method of claim 30, wherein at least one of the oligonucleotide primers comprises at least about 10 contiguous nucleotides of a polynucleotide sequence of SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291.

32. A method for detecting *Chlamydia* infection in a biological sample, comprising:

(a) contacting the sample with one or more oligonucleotide probes specific for a polynucleotide molecule comprising a sequence of SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291; and

(b) detecting in the sample a polynucleotide sequence that hybridizes to the oligonucleotide probe, thereby detecting *Chlamydia* infection.

33. The method of claim 32 wherein the probe comprises at least about 15 contiguous nucleotides of a polynucleotide sequence of SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291.

34. A method for detecting *Chlamydia* infection in a biological sample, comprising:

(a) contacting the biological sample with a binding agent which is capable of binding to a polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said antigen comprises an amino acid sequence encoded by a polynucleotide sequence selected from the group consisting of: (i) a sequence recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291, (ii) sequences complementary to a sequence of (i), and (c) polynucleotide sequences that hybridize to a sequence of (i) or (ii) under moderately stringent conditions; and

(b) detecting in the sample a polypeptide that binds to the binding agent, thereby detecting *Chlamydia* infection in the biological sample.

35. A method of detecting *Chlamydia* infection in a biological sample, comprising:

(a) contacting the biological sample with a binding agent which is capable of binding to a fusion protein comprising a polypeptide, the polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said antigen comprises an amino acid sequence encoded by a polynucleotide sequence selected from the group consisting of: (i) a sequence recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291, (ii) sequences

complementary to a sequence of (i), and (c) polynucleotide sequences that hybridize to a sequence of (i) or (ii) under moderately stringent conditions; and

(b) detecting in the sample a polypeptide that binds to the binding agent, thereby detecting *Chlamydia* infection in the biological sample.

36. The method of any one of claims 34 and 35 wherein the binding agent is a monoclonal antibody.

37. The method of any one of claims 34 and 35 wherein the binding agent is a polyclonal antibody.

38. The method of any one of claims 34 and 35 wherein the biological sample is selected from the group consisting of whole blood, sputum, serum, plasma, saliva, cerebrospinal fluid and urine.

39. A diagnostic kit comprising:

(a) a polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said antigen comprises an amino acid sequence encoded by a polynucleotide sequence selected from the group consisting of: (i) a sequence recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291, (ii) sequences complementary to a sequence of (i), and (c) polynucleotide sequences that hybridize to a sequence of (i) or (ii) under moderately stringent conditions; and

(b) a detection reagent.

40. A diagnostic kit comprising:

(a) a fusion protein comprising a polypeptide, the polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said antigen comprises an amino acid sequence encoded by a polynucleotide sequence selected from the group consisting of: (i) a sequence recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291 (ii) sequences complementary to a sequence of (i), and (c) polynucleotide sequences that hybridize to a sequence of (i) or (ii) under moderately stringent conditions; and

(b) a detection reagent.

41. The kit of claims 39 or 40 wherein the polypeptide is immobilized on a solid support.



42. The kit of claims 39 or 40 wherein the detection reagent comprises a reporter group conjugated to a binding agent.

43. The kit of claim 42 wherein the binding agent is selected from the group consisting of anti-immunoglobulins, Protein G, Protein A and lectins.

44. The kit of claim 42 wherein the reporter group is selected from the group consisting of radioisotopes, fluorescent groups, luminescent groups, enzymes, biotin and dye particles.

45. A diagnostic kit comprising at least two oligonucleotide primers, at least one of the oligonucleotide primers being specific for a polynucleotide molecule comprising a polynucleotide sequence of SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291.

46. A diagnostic kit according to claim 43, wherein at least one of the oligonucleotide primers comprises at least about 10 contiguous nucleotides of a sequence of SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291.

47. A diagnostic kit comprising at least one oligonucleotide probe, the oligonucleotide probe being specific for a polynucleotide molecule comprising a sequence of SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291.

48. A kit according to claim 47, wherein the oligonucleotide probe comprises at least about 15 contiguous nucleotides of a polynucleotide sequence of SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291.

49. A diagnostic kit comprising:  
(a) at least one antibody, or antigen-binding fragment thereof, according to claim 22; and  
(b) a detection reagent.

50. A method for treating *Chlamydia* infection in a patient, comprising the steps of:  
(a) obtaining peripheral blood cells from the patient;

(b) incubating the cells in the presence of at least one polypeptide, the polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said antigen comprises an amino acid sequence encoded by a polynucleotide sequence selected from the group consisting of: (i) a sequence recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291 (ii) sequences complementary to a sequence of (i), and (c) polynucleotide sequences that hybridize to a sequence of (i) or (ii) under moderately stringent conditions, such that T cells proliferate; and

(c) administering to the patient the proliferated T cells.

51. A method for treating *Chlamydia* infection in a patient, comprising the steps of:

(a) obtaining peripheral blood cells from the patient;

(b) incubating the cells in the presence of at least one polynucleotide, comprises a polynucleotide sequence selected from the group consisting of: (i) a sequence recited in SEQ ID NO: 169-174, 181-188, 263, 265 and 267-291 (ii) sequences complementary to a sequence of (i), and (c) polynucleotide sequences that hybridize to a sequence of (i) or (ii) under moderately stringent conditions, such that T cells proliferate; and

(c) administering to the patient the proliferated T cells.

52. The method of any one of claims 50 and 51 wherein the step of incubating the T cells is repeated one or more times.

53. The method of any one of claims 50 and 51 wherein step (a) further comprises separating T cells from the peripheral blood cells, and the cells incubated in step (b) are the T cells.

54. The method of any one of claims 50 and 51 wherein step (a) further comprises separating CD4<sup>+</sup> cells or CD8<sup>+</sup> T cells from the peripheral blood cells, and the cells proliferated in step (b) are CD4<sup>+</sup> or CD8<sup>+</sup> T cells.

55. The method of any one of claims 50 and 51 wherein step (a) further comprises separating gamma/delta T lymphocytes from the peripheral blood cells, and the cells proliferated in step (b) are gamma/delta T lymphocytes.

56. The method of any one of claims 50 and 51 wherein step (b) further comprises cloning one or more T cells that proliferated in the presence of the polypeptide.

57. A pharmaceutical composition for the treatment of *Chlamydia* infection in a patient, comprising T cells proliferated in the presence of a polypeptide of claim 1, in combination with a physiologically acceptable carrier.

58. A pharmaceutical composition for the treatment of *Chlamydia* infection in a patient, comprising T cells proliferated in the presence of a polynucleotide of claim 3, in combination with a physiologically acceptable carrier.

59. A method for treating *Chlamydia* infection in a patient, comprising the steps of:

- (a) incubating antigen presenting cells in the presence of at least one polypeptide of claim 1;
- (b) administering to the patient the incubated antigen presenting cells.

60. A method for treating *Chlamydia* infection in a patient, comprising the steps of:

- (a) introducing at least one polynucleotide of claim 3 into antigen presenting cells;
- (b) administering to the patient the antigen presenting cells.

61. The method of claims 59 or 60 wherein the antigen presenting cells are selected from the group consisting of dendritic cells, macrophage cells, B cells fibroblast cells, monocyte cells, and stem cells.

62. A pharmaceutical composition for the treatment of *Chlamydia* infection in a patient, comprising antigen presenting cells incubated in the presence of a polypeptide of claim 1, in combination with a physiologically acceptable carrier.

63. A pharmaceutical composition for the treatment of *Chlamydia* infection in a patient, comprising antigen presenting cells incubated in the presence of a polynucleotide of claim 3, in combination with a physiologically acceptable carrier.

64. A polypeptide comprising an immunogenic portion of a *Chlamydia* antigen, wherein said immunogenic portion comprises a sequence of SEQ ID NO: 246, 247 and 254-256.

65. An immunogenic epitope of a *Chlamydia* antigen, comprising a sequence of SEQ ID NO: 246, 247 or 254-256.

66. An isolated polypeptide comprising a sequence recited in any one of SEQ ID NO: 224-262, 246, 247, 254-256, 292 and 294-305.

67. A recombinant fusion polypeptide comprising a an amino acid sequence of a Ra12 polypeptide and an amino acid sequence of a Chlamydial polypeptide.

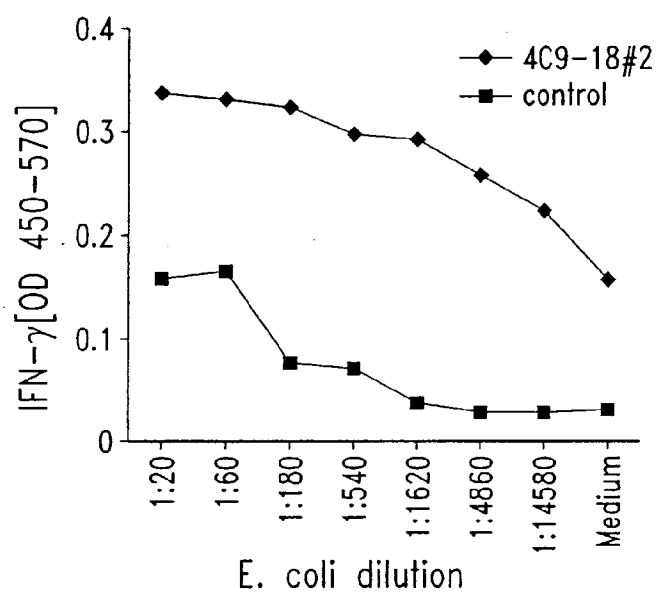
68. The recombinant polypeptide of claims 67, wherein the Chlamydial polypeptide is a Pmp polypeptide.

69. The recombinant polypeptide of claims 67, wherein the Chlamydial polypeptide is a PmpA, PmpF, PmpH, PmpB, or PmpC.

70. The recombinant polypeptide of claims 67, wherein the amino acid sequence of the fusion polypeptide is a sequence selected from the group consisting of SEQ ID NOs: 309, 313, 317, 321, 325, 329, 333, 337, 341, 345, 349, 353 and 357.

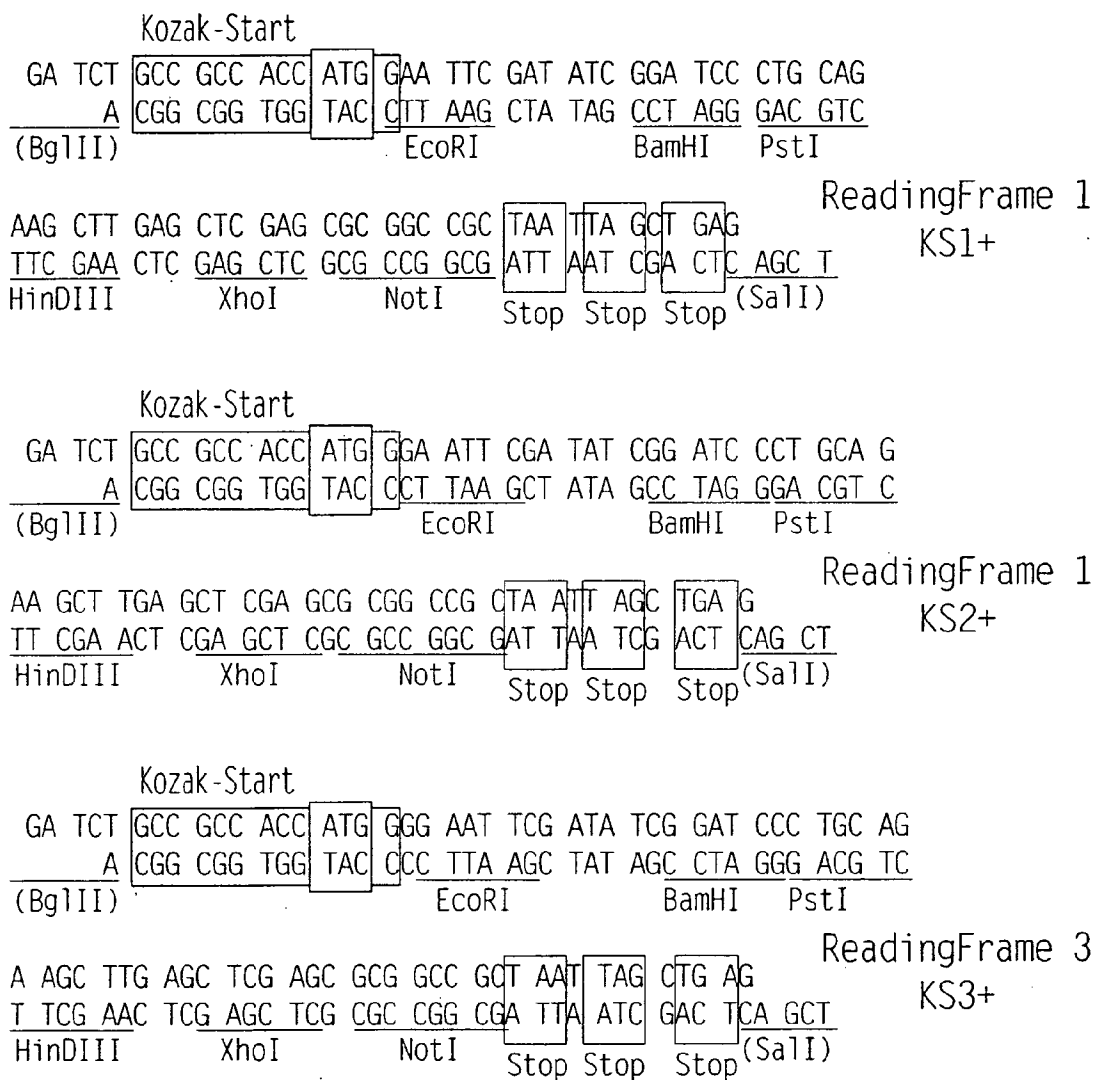
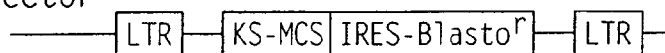
71. A recombinant DNA molecule encoding a fusion polypeptide according to claim 67.

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*Fig. 1*

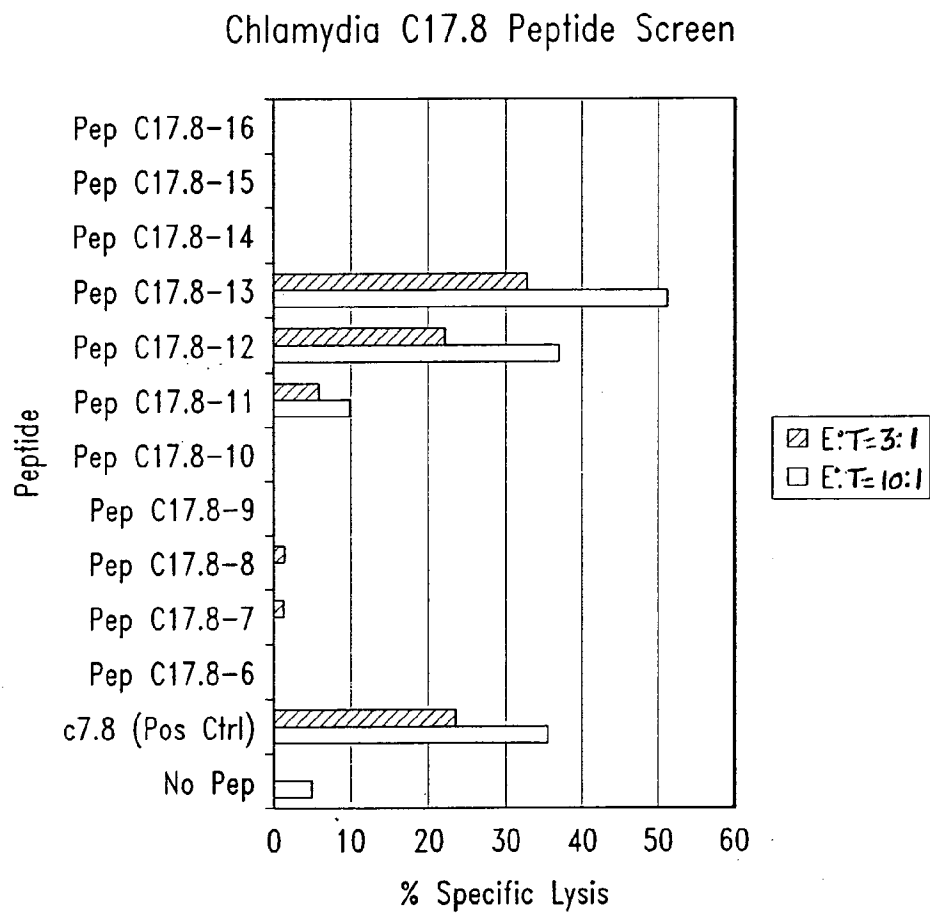
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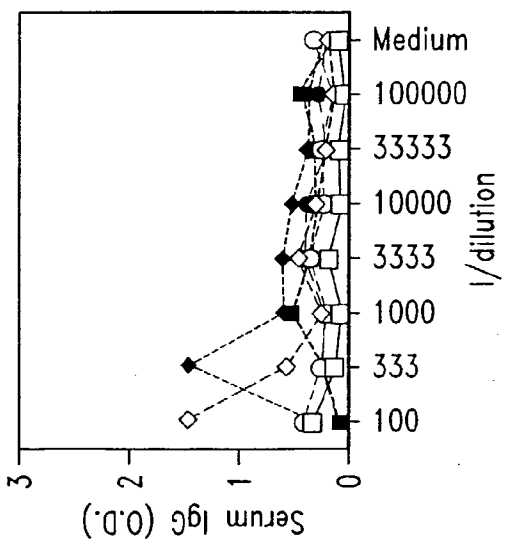
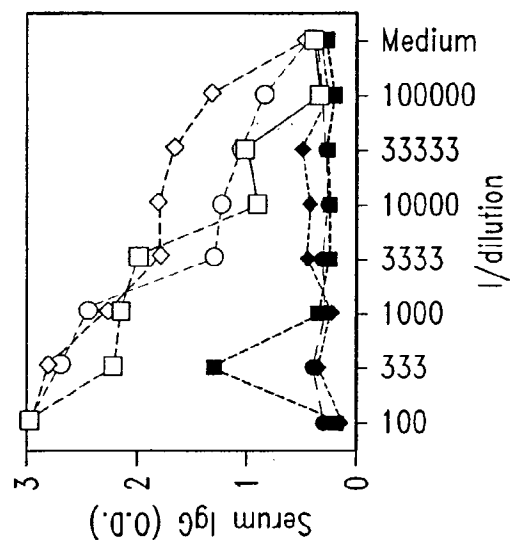
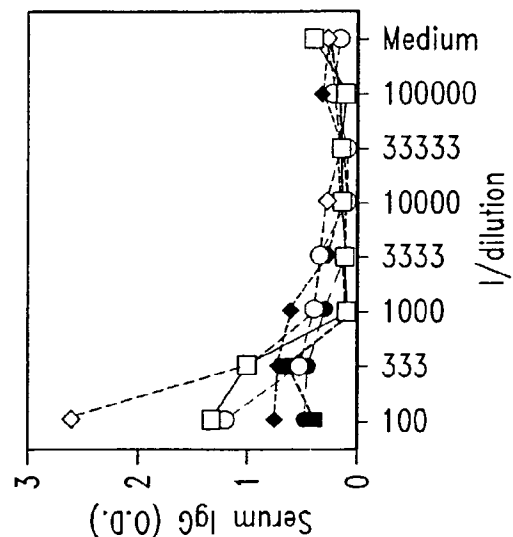
Retroviral vector  
pBIB-KS



*Fig. 2*

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*Fig. 3*

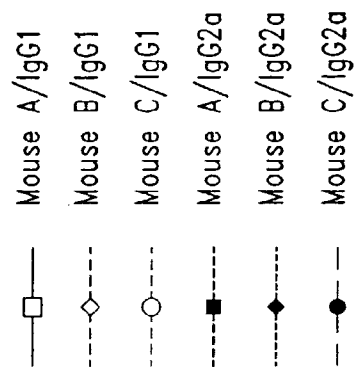


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Fig. 4C

Fig. 4B

Fig. 4A





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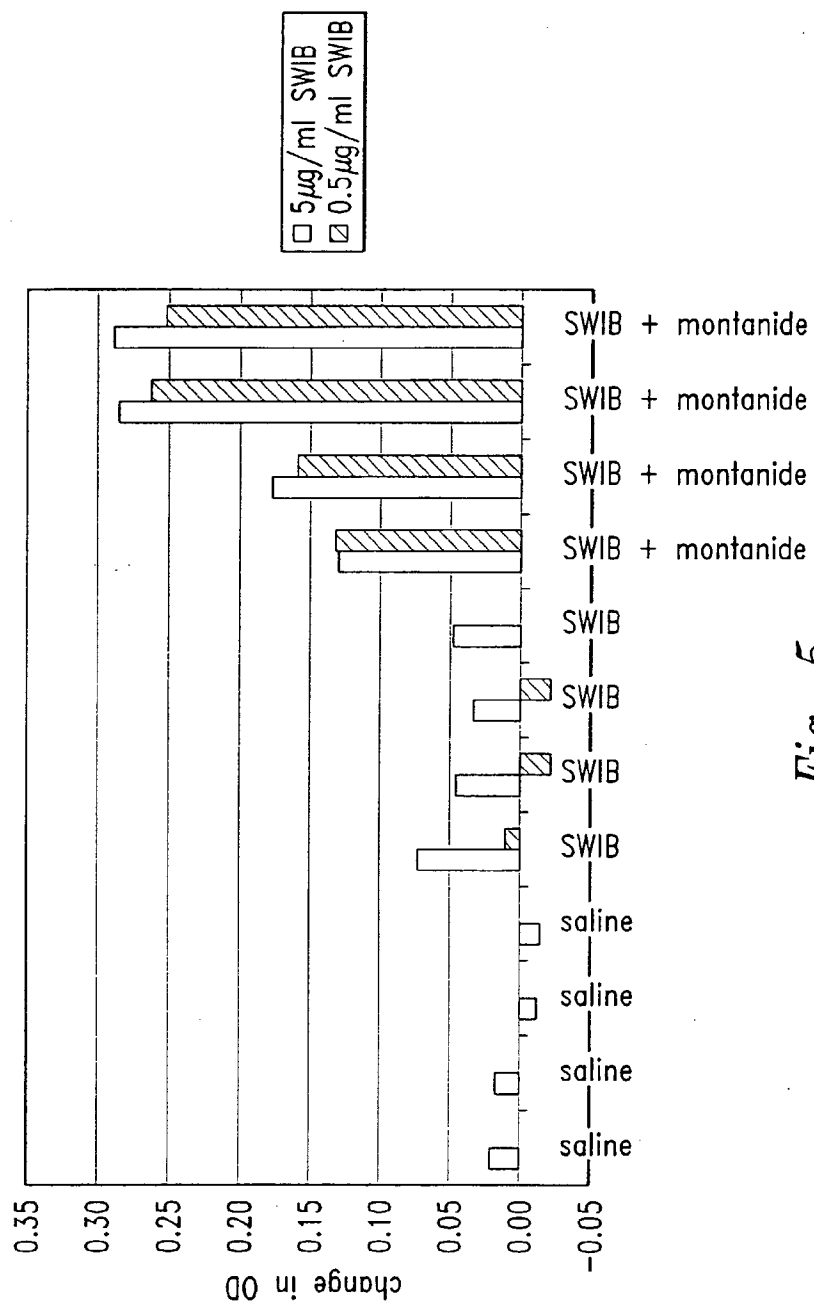


Fig. 5

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CP SWIB Nde (5' primer)

5' GATATACATATGCATCACCATCACCATCACATGAGTCAAAAAATAAAAACTCT

CP SWIB EcoRI (3' primer)

5' CTCGAGGAATTCTTATTTACAATATGTTTGA

CP S13 Nde (5' primer)

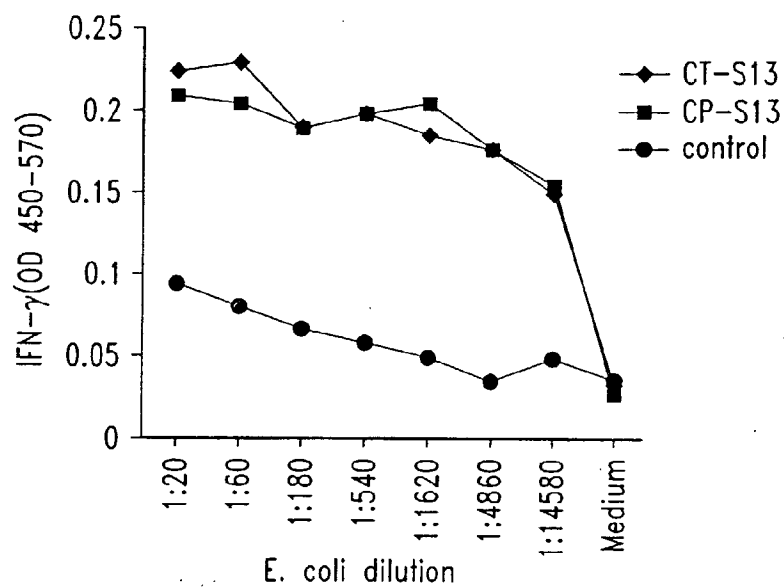
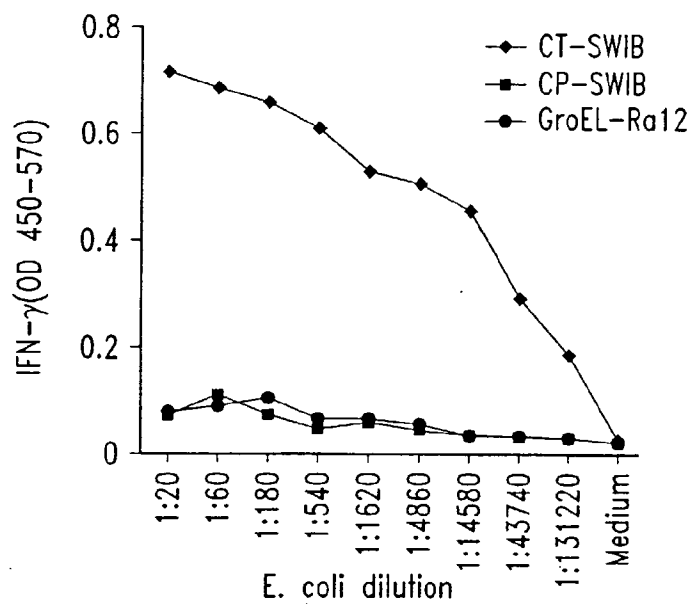
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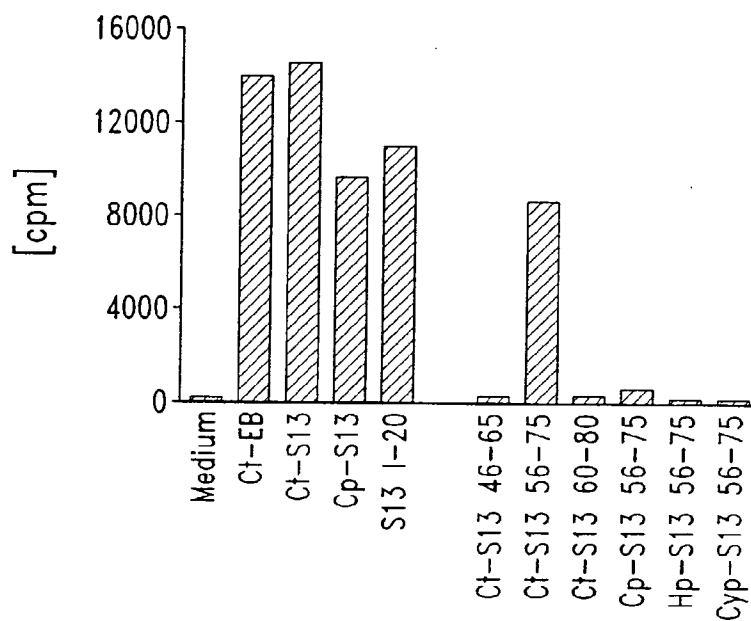
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*Fig. 6*

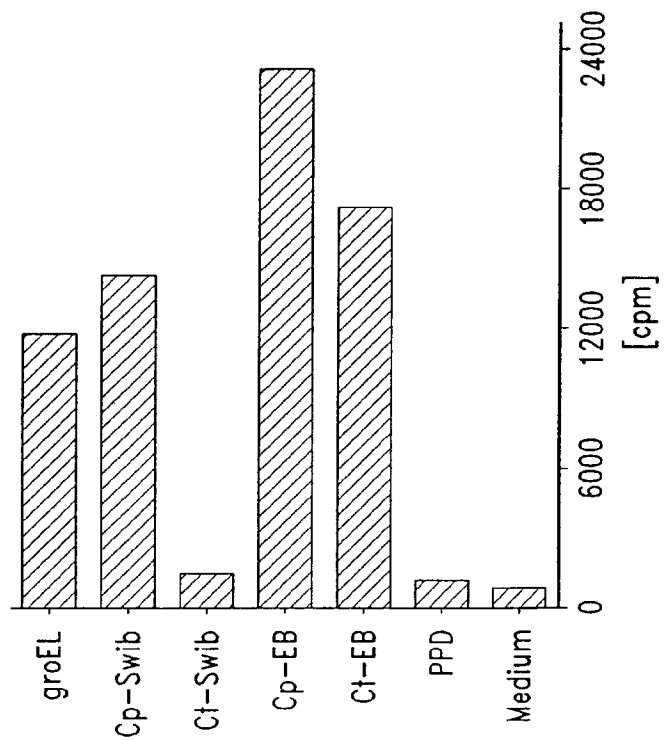
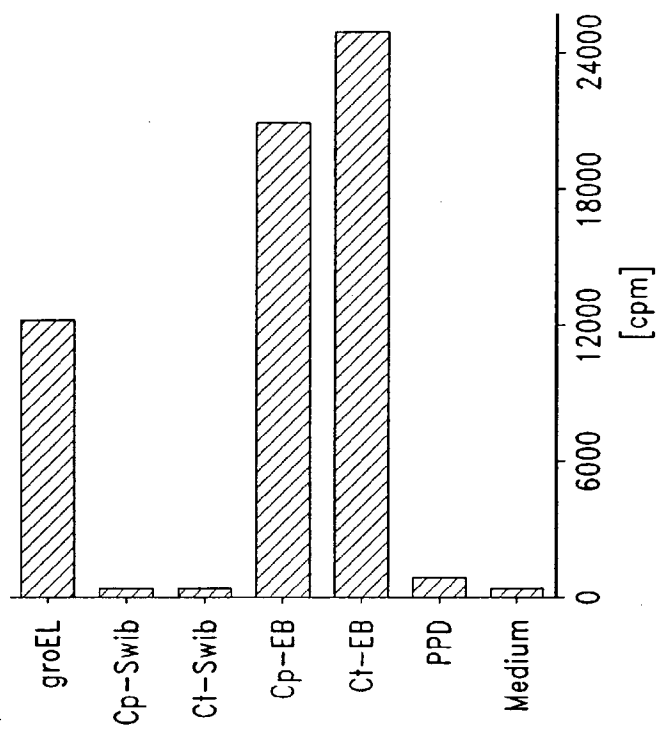
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*Fig. 7A**Fig. 7B*

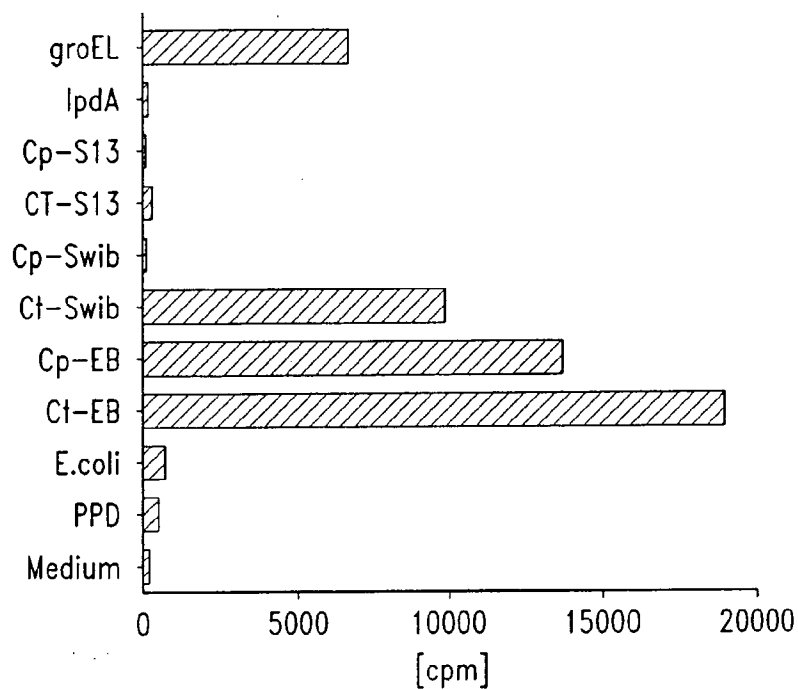
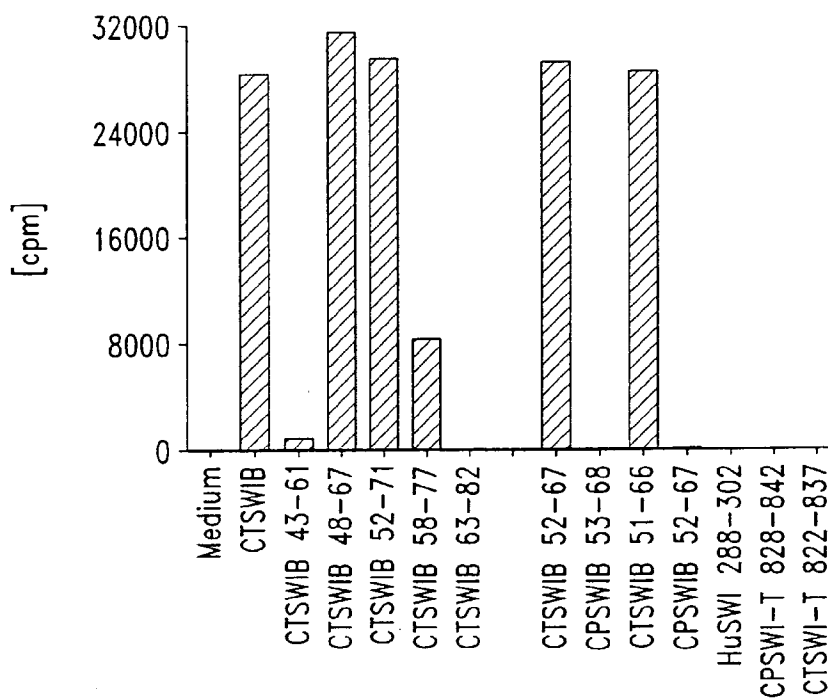
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*Fig. 8*

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*Fig. 9B**Fig. 9A*

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*Fig. 10**Fig. 11*

## SEQUENCE LISTING

<110> Corixa Corporation  
 Probst, Peter  
 Bhatia, Ajay  
 Skeiky, Yasir A. W.  
 Fling, Steven P.  
 Scholler, John

<120> COMPOSITIONS AND METHODS FOR TREATMENT AND  
 DIAGNOSIS OF CHLAMYDIAL INFECTION

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<140> PCT

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ttggaataga tattcctgcg aaaaagaaat taaaaataag tcttacatat atttatggaa 120  
tagggccagc tcttttctaaa gagattattg ctagattgca gttgaatccc gaagctagag 180  
ctgcagagtt gactgaggaa gaggttggtc gactaaacgc tcttttacag tcggattacg 240  
ttgttgaagg ggatttgccg cgtcgtgtgc aatctgatat caaacgtctg attactatcc 300  
atgcttatcg tggacaaaga catagacttt ctttgcctgt tcgtgggtcag agaacaaaaa 360  
caaattctcg cacgcgtaag ggtaaacgta aaactattgc aggtaagaag aaataataat 420  
ttttaggaga gagtgttttg gttaaaaatc aagcgcaaaa aagaggcgta aaaagaaaac 480  
aagtaaaaaa cattccttcg ggcgttggtc atgttaaaggc tacttttaat aatacaattg 540  
taaccataac agacc 555

<210> 5  
<211> 86  
<212> PRT  
<213> Chlamydia trachomatis

<400> 5  
Met Ser Gln Asn Lys Asn Ser Ala Phe Met Gln Pro Val Asn Val Ser  
1 5 10 15  
Ala Asp Leu Ala Ala Ile Val Gly Ala Gly Pro Met Pro Arg Thr Glu  
20 25 30  
Ile Ile Lys Lys Met Trp Asp Tyr Ile Lys Glu Asn Ser Leu Gln Asp  
35 40 45  
Pro Thr Asn Lys Arg Asn Ile Asn Pro Asp Asp Lys Leu Ala Lys Val  
50 55 60  
Phe Gly Thr Glu Lys Pro Ile Asp Met Phe Gln Met Thr Lys Met Val  
65 70 75 80  
Ser Gln His Ile Ile Lys  
85

<210> 6  
<211> 61  
<212> PRT  
<213> Chlamydia trachomatis

<400> 6  
Ile Val Gly Ala Gly Pro Met Pro Arg Thr Glu Ile Ile Lys Lys Met  
1 5 10 15  
Trp Asp Tyr Ile Lys Glu Asn Ser Leu Gln Asp Pro Thr Asn Lys Arg  
20 25 30  
Asn Ile Asn Pro Asp Asp Lys Leu Ala Lys Val Phe Gly Thr Glu Lys  
35 40 45  
Pro Ile Asp Met Phe Gln Met Thr Lys Met Val Ser Gln  
50 55 60

<210> 7  
<211> 36  
<212> PRT  
<213> Chlamydia trachomatis



&lt;400&gt; 7

Ala	Ala	Thr	Ser	Cys	Glu	Leu	Ala	Asn	Gln	His	Gly	His	Leu	Gln	Phe
1				5					10					15	
Pro	Leu	Leu	Thr	Arg	Ser	Leu	Glu	Leu	Met	Leu	Leu	Pro	Ser	Gln	Ser
			20					25					30		
Gln	Ser	His	Arg												
			35												

&lt;210&gt; 8

&lt;211&gt; 18

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 8

Leu	Arg	His	His	Ala	Ser	Leu	Gln	Thr	Asn	Met	Asp	Ile	Ser	Asn	Phe
1				5					10					15	
Pro	Phe														

&lt;210&gt; 9

&lt;211&gt; 5

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 9

Leu	Ala	Leu	Trp	Asn
1				5

&lt;210&gt; 10

&lt;211&gt; 11

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 10

Cys	Cys	Tyr	Arg	Val	Asn	His	Asn	His	Ile	Asp
1				5					10	

&lt;210&gt; 11

&lt;211&gt; 36

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 11

Val	Asp	Val	Ile	Val	Ile	Asp	Ser	Val	Ala	Ala	Leu	Val	Pro	Lys	Ser
1				5					10					15	
Glu	Leu	Glu	Gly	Glu	Ile	Gly	Asp	Val	His	Val	Gly	Leu	Gln	Ala	Arg
			20					25					30		
Met	Met	Ser	Gln												
			35												

&lt;210&gt; 12

&lt;211&gt; 122

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 12

Met	Pro	Arg	Ile	Ile	Gly	Ile	Asp	Ile	Pro	Ala	Lys	Lys	Lys	Leu	Lys
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

```

      1           5           10           15
Ile Ser Leu Thr Tyr Ile Tyr Gly Ile Gly Pro Ala Leu Ser Lys Glu
      20           25           30
Ile Ile Ala Arg Leu Gln Leu Asn Pro Glu Ala Arg Ala Ala Glu Leu
      35           40           45
Thr Glu Glu Glu Val Gly Arg Leu Asn Ala Leu Leu Gln Ser Asp Tyr
      50           55           60
Val Val Glu Gly Asp Leu Arg Arg Arg Val Gln Ser Asp Ile Lys Arg
      65           70           75           80
Leu Ile Thr Ile His Ala Tyr Arg Gly Gln Arg His Arg Leu Ser Leu
      85           90           95
Pro Val Arg Gly Gln Arg Thr Lys Thr Asn Ser Arg Thr Arg Lys Gly
      100          105          110
Lys Arg Lys Thr Ile Ala Gly Lys Lys Lys
      115          120

```

```

<210> 13
<211> 20
<212> PRT
<213> Chlamydia trachomatis

```

```

      <400> 13
Asp Pro Thr Asn Lys Arg Asn Ile Asn Pro Asp Asp Lys Leu Ala Lys
      1           5           10           15
Val Phe Gly Thr
      20

```

```

<210> 14
<211> 20
<212> PRT
<213> Chlamydia trachomatis

```

```

      <400> 14
Asp Asp Lys Leu Ala Lys Val Phe Gly Thr Glu Lys Pro Ile Asp Met
      1           5           10           15
Phe Gln Met Thr
      20

```

```

<210> 15
<211> 161
<212> DNA
<213> Chlamydia trachomatis

```

```

      <400> 15
atctttgtgt gtctcataag cgcagagcgg ctgcggctgt ctgtagcttc atcggaggaa      60
ttacctacct cgcgacattc ggagctatcc gtccgattct gtttgtcaac aaaatgctgg      120
cgcaaccggt tctttcttcc caaactaaag caaatatggg a                          161

```

```

<210> 16
<211> 897
<212> DNA
<213> Chlamydia trachomatis

```

```

      <400> 16
atggcttcta tatcggacg tttagggctt ggtacaggga atgctctaaa agcttttttt      60
acacagccca acaataaaat ggcaagggtg gtaaataaga cgaagggaat ggataagact      120
attaagggtg ccaagtctgc tgccgaattg accgcaaata ttttggaaca agctggaggc      180
gcgggctctt ccgcacacat tacagcttcc caagtgtcca aaggattagg ggatgcgaga      240

```

```

actgttgctcg ctttagggaa tgcctttaac ggagcgttgc caggaacagt tcaaagtgcg 300
caaagcttct tctctcacat gaaagctgct agtcagaaaa cgcaagaagg ggatgagggg 360
ctcacagcag atctttgtgt gtctcataag cgcagagcgg ctgcggctgt ctgtagcatc 420
atcggaggaa ttacctacct cgcgacattc ggagctatcc gtccgattct gtttgtcaac 480
aaaatgctgg caaaaccgtt tctttcttcc caaactaaag caaatatggg atcttctggt 540
agctatatta tggcggctaa ccatgcagcg tctgtggtgg gtgctggact cgctatcagt 600
gcggaaagag cagattgcga agcccgtgc gctcgtattg cgagagaaga gtcgttactc 660
gaagtgcggg gagaggaaaa tgcttgcgag aagaaagtcg ctggagagaa agccaagacg 720
ttcacgcgca tcaagtatgc actcctcact atgctcgaga agtttttgga atgcgttgcc 780
gacgttttca aattggtgcc gctgcctatt acaatgggta ttcgtgcgat tgtggtgct 840
ggatgtacgt tcacttctgc aattattgga ttgtgcactt tctgcgccag agcataa 897

```

&lt;210&gt; 17

&lt;211&gt; 298

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 17

```

Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu
 1          5          10          15
Lys Ala Phe Phe Thr Gln Pro Asn Asn Lys Met Ala Arg Val Val Asn
          20          25          30
Lys Thr Lys Gly Met Asp Lys Thr Ile Lys Val Ala Lys Ser Ala Ala
          35          40          45
Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser
          50          55          60
Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Ala Arg
65          70          75          80
Thr Val Val Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr
          85          90          95
Val Gln Ser Ala Gln Ser Phe Phe Ser His Met Lys Ala Ala Ser Gln
          100          105          110
Lys Thr Gln Glu Gly Asp Glu Gly Leu Thr Ala Asp Leu Cys Val Ser
          115          120          125
His Lys Arg Arg Ala Ala Ala Val Cys Ser Ile Ile Gly Gly Ile
          130          135          140
Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile Leu Phe Val Asn
145          150          155          160
Lys Met Leu Ala Lys Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met
          165          170          175
Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val
          180          185          190
Val Gly Ala Gly Leu Ala Ile Ser Ala Glu Arg Ala Asp Cys Glu Ala
          195          200          205
Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Leu Leu Glu Val Pro Gly
          210          215          220
Glu Glu Asn Ala Cys Glu Lys Lys Val Ala Gly Glu Lys Ala Lys Thr
225          230          235          240
Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu
          245          250          255
Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met
          260          265          270
Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Ile
          275          280          285
Ile Gly Leu Cys Thr Phe Cys Ala Arg Ala
          290          295

```

&lt;210&gt; 18

<211> 18  
 <212> PRT  
 <213> Chlamydia trachomatis

<400> 18  
 Arg Ala Ala Ala Ala Val Cys Ser Phe Ile Gly Gly Ile Thr  
 1 5 10 15  
 Tyr Leu

<210> 19  
 <211> 18  
 <212> PRT  
 <213> Chlamydia trachomatis

<400> 19  
 Cys Ser Phe Ile Gly Gly Ile Thr Tyr Leu Ala Thr Phe Gly Ala Ile  
 1 5 10 15  
 Arg Pro

<210> 20  
 <211> 216  
 <212> PRT  
 <213> Chlamydia trachomatis

<400> 20  
 Met Arg Gly Ser Gln Gln Ile Phe Val Cys Leu Ile Ser Ala Glu Arg  
 1 5 10 15  
 Leu Arg Leu Ser Val Ala Ser Ser Glu Glu Leu Pro Thr Ser Arg His  
 20 25 30  
 Ser Glu Leu Ser Val Arg Phe Cys Leu Ser Thr Lys Cys Trp Gln Asn  
 35 40 45  
 Arg Phe Phe Leu Pro Lys Leu Lys Gln Ile Trp Asp Leu Leu Leu Ala  
 50 55 60  
 Ile Leu Trp Arg Leu Thr Met Gln Arg Leu Trp Trp Val Leu Asp Ser  
 65 70 75 80  
 Leu Ser Val Arg Lys Glu Gln Ile Ala Lys Pro Ala Ala Leu Val Leu  
 85 90 95  
 Arg Glu Lys Ser Arg Tyr Ser Lys Cys Arg Glu Arg Lys Met Leu Ala  
 100 105 110  
 Arg Arg Lys Ser Leu Glu Arg Lys Pro Arg Arg Ser Arg Ala Ser Ser  
 115 120 125  
 Met His Ser Ser Leu Cys Ser Arg Ser Phe Trp Asn Ala Leu Pro Thr  
 130 135 140  
 Phe Ser Asn Trp Cys Arg Cys Leu Leu Gln Trp Val Phe Val Arg Leu  
 145 150 155 160  
 Trp Leu Leu Asp Val Arg Ser Leu Leu Gln Leu Leu Asp Cys Ala Leu  
 165 170 175  
 Ser Ala Pro Glu His Lys Gly Phe Phe Lys Phe Leu Lys Lys Lys Ala  
 180 185 190  
 Val Ser Lys Lys Lys Gln Pro Phe Leu Ser Thr Lys Cys Leu Ala Phe  
 195 200 205  
 Leu Ile Val Lys Ile Val Phe Leu  
 210 215

<210> 21  
 <211> 1256

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 21

ctcgtgccgg	cacgagcaaa	gaaatccctc	aaaaaatggc	cattattggc	ggtggtgtga	60
tcggttgcca	attcgcttcc	ttattccata	cgtaggctc	cgaagtttct	gtgatcgaag	120
caagctctca	aatccttgct	ttgaataatc	cagatatttc	aaaaaccatg	ttcgataaat	180
tcacccgaca	aggactccgt	ttcgtactag	aagcctctgt	atcaaataat	gaggatatag	240
gagatcgcg	tcggttaact	atcaatggga	atgtcgaaga	atacgattac	gttctcgtat	300
ctataggacg	ccgtttgaat	acagaaaata	ttggcttgga	taaagctggg	gttatttgtg	360
atgaacgcgg	agtcacccct	accgatgcc	caatgcgcac	aaacgtacct	aacatttatg	420
ctattggaga	tatcacagga	aaatggcaac	ttgccatgt	agcttctcat	caaggaatca	480
ttgcagcacg	gaatataggt	ggccataaag	aggaaatcga	ttactctgct	gtcccttctg	540
tgatctttac	cttccctgaa	gtcgcttcag	taggcctctc	cccaacagca	gctcaacaac	600
atctccttct	tcgcttactt	tttctgaaaa	atttgataca	gaagaagaat	tcctcgca	660
cttgcgagga	ggagggcgtc	tggaagacca	gttgaaat	gctaagtttt	ctgagcggtt	720
tgattctttg	cgagaattat	ccgctaagct	tggttacgat	agcgatggag	agactgggga	780
tttcttcaac	gaggagtacg	acgaacgaaga	agaggaaatc	aaaccgaaga	aaactacgaa	840
acgtggacgt	aagaagagcc	gttcataagc	cttgctttta	agggttggtg	gttttacttc	900
tctaaaatcc	aaatggttgc	tgtgcaaaaa	agtagtttgc	gtttccggat	agggcgtaaa	960
tcgctgcat	gaaagattgc	ttcgagagcg	gcacgcggtg	ggagatccc	gatactttct	1020
ttcagatacg	aataagcata	gctgttccca	gaataaaaa	ggccgacgct	aggaacaaca	1080
agatttagat	agagcttgtg	tagcaggtaa	actgggttat	atgttgctgg	gcgtgttagt	1140
tctagaatac	ccaagtgtcc	tccaggttgt	aatactcgat	acacttccct	aagagcctct	1200
aatggatagg	ataagttccg	taatccatag	gccatagaag	ctaaacgaaa	cgtatt	1256

&lt;210&gt; 22

&lt;211&gt; 601

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 22

ctcgtgccgg	cacgagcaaa	gaaatccctc	aaaaaatggc	cattattggc	ggtggtgtga	60
tcggttgcca	attcgcttcc	ttattccata	cgtaggctc	cgaagtttct	gtgatcgaag	120
caagctctca	aatccttgct	ttgaataatc	cagatatttc	aaaaaccatg	ttcgataaat	180
tcacccgaca	aggactccgt	ttcgtactag	aagcctctgt	atcaaataat	gaggatatag	240
gagatcgcg	tcggttaact	atcaatggga	atgtcgaaga	atacgattac	gttctcgtat	300
ctataggacg	ccgtttgaat	acagaaaata	ttggcttgga	taaagctggg	gttatttgtg	360
atgaacgcgg	agtcacccct	accgatgcc	caatgcgcac	aaacgtacct	aacatttatg	420
ctattggaga	tatcacagga	aaatggcaac	ttgccatgt	agcttctcat	caaggaatca	480
ttgcagcacg	gaatataggt	ggccataaag	aggaaatcga	ttactctgct	gtcccttctg	540
tgatctttac	cttccctgaa	gtcgcttcag	taggcctctc	cccaacagca	gctcaacaac	600
a						601

&lt;210&gt; 23

&lt;211&gt; 270

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 23

acatctcctt	cttcgcttac	tttttctgaa	aaatttgata	cagaagaaga	attcctcgca	60
cacttgcgag	gaggagggcg	tctggaagac	cagttgaatt	tagctaagtt	ttctgagcgt	120
tttgattctt	tcgagaatt	atccgctaag	cttggttacg	atagcgatgg	agagactggg	180
gatttcttca	acgaggagta	cgacgacgaa	gaagaggaaa	tcaaaccgaa	gaaaactacg	240
aaacgtggac	gtaagaagag	ccgttcataa				270

&lt;210&gt; 24

&lt;211&gt; 363

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 24

ttactttctct	aaaatccaaa	tggttgctgt	gccaaaaagt	agtttgcggt	tccggatagg	60
gcgtaaagtgc	gctgcatgaa	agattgcttc	gagagcggca	tgcggtggga	gatcccggt	120
actttctttc	agatacgaat	aagcatagct	gttcccagaa	taaaaacggc	cgacgctagg	180
aacaacaaga	tttagataga	gcttggttag	caggtaaaact	gggttatatg	ttgctgggcg	240
tgtagttct	agaataccca	agtgtcctcc	agggttgtaat	actcgataca	cttccctaag	300
agcctctaata	ggataggata	agttccgtaa	tccataggcc	atagaagcta	aacgaaacgt	360
att						363

&lt;210&gt; 25

&lt;211&gt; 696

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 25

gctcgtgccc	gcacgagcaa	agaaatccct	caaaaaatgg	ccattattgg	cggtggtgtg	60
atcgggttgcg	aattcgcttc	cttattccat	acgttaggct	ccgaagtttc	tgtgatcgaa	120
gcaagctctc	aaatccttgc	tttgaataat	ccagatat	caaaaacat	gttcgataaa	180
ttcacccgac	aaggactccg	tttcgtacta	gaagcctctg	tatcaaata	tgaggatata	240
ggagatcgcg	ttcggttaac	tatcaatggg	aatgtcgaag	aatacgatta	cgttctcgta	300
tctataggac	gccgtttgaa	tacagaaaat	attggcttgg	ataaagctgg	tgttatttgt	360
gatgaacgcg	gagtcacccc	taccgatgcc	acaatgcgca	caaacgtacc	taacatttat	420
gctattggag	atatcacagg	aaaatggcaa	cttgcccatg	tagcttctca	tcaaggaatc	480
attgcagcac	ggaatatagg	tggccataaa	gaggaaatcg	attactctgc	tgtcccttct	540
gtgatcttta	ccttccctga	agtcgcttca	gtaggcctct	ccccaacagc	agctcaacaa	600
catctccttc	ttcgcttact	ttttctgaaa	aatttgatac	agaagaagaa	ttcctcgcac	660
acttgcgagg	aggagggcgt	ctggaagacc	agttga			696

&lt;210&gt; 26

&lt;211&gt; 231

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 26

Ala	Arg	Ala	Gly	Thr	Ser	Lys	Glu	Ile	Pro	Gln	Lys	Met	Ala	Ile	Ile
1				5					10					15	
Gly	Gly	Gly	Val	Ile	Gly	Cys	Glu	Phe	Ala	Ser	Leu	Phe	His	Thr	Leu
			20					25					30		
Gly	Ser	Glu	Val	Ser	Val	Ile	Glu	Ala	Ser	Ser	Gln	Ile	Leu	Ala	Leu
		35				40					45				
Asn	Asn	Pro	Asp	Ile	Ser	Lys	Thr	Met	Phe	Asp	Lys	Phe	Thr	Arg	Gln
	50					55					60				
Gly	Leu	Arg	Phe	Val	Leu	Glu	Ala	Ser	Val	Ser	Asn	Ile	Glu	Asp	Ile
65				70					75				80		
Gly	Asp	Arg	Val	Arg	Leu	Thr	Ile	Asn	Gly	Asn	Val	Glu	Glu	Tyr	Asp
		85						90					95		
Tyr	Val	Leu	Val	Ser	Ile	Gly	Arg	Arg	Leu	Asn	Thr	Glu	Asn	Ile	Gly
		100				105						110			
Leu	Asp	Lys	Ala	Gly	Val	Ile	Cys	Asp	Glu	Arg	Gly	Val	Ile	Pro	Thr
	115					120					125				
Asp	Ala	Thr	Met	Arg	Thr	Asn	Val	Pro	Asn	Ile	Tyr	Ala	Ile	Gly	Asp
	130					135					140				
Ile	Thr	Gly	Lys	Trp	Gln	Leu	Ala	His	Val	Ala	Ser	His	Gln	Gly	Ile
145				150					155				160		
Ile	Ala	Ala	Arg	Asn	Ile	Gly	Gly	His	Lys	Glu	Glu	Ile	Asp	Tyr	Ser

```

                165                170                175
Ala Val Pro Ser Val Ile Phe Thr Phe Pro Glu Val Ala Ser Val Gly
                180                185                190
Leu Ser Pro Thr Ala Ala Gln Gln His Leu Leu Leu Arg Leu Leu Phe
                195                200                205
Leu Lys Asn Leu Ile Gln Lys Lys Asn Ser Ser His Thr Cys Glu Glu
                210                215                220
Glu Gly Val Trp Lys Thr Ser
225                230

```

```

<210> 27
<211> 264
<212> DNA
<213> Chlamydia pneumoniae

```

```

<400> 27
atgagtcaaaa aaaataaaaa ctctgctttt atgcatcccg tgaatatttc cacagattta      60
gcagttatag ttggcaaggg acctatgccc agaaccgaaa ttgtaaagaa agtttgggaa      120
tacattaaaa aacacaactg tcaggatcaa aaaaataaac gtaatatcct tcccgatgcg      180
aatcttgcca aagtcttttg ctctagtgat cctatcgaca tgttccaaat gaccaaagcc      240
ctttccaaac atattgtaaa ataa                                     264

```

```

<210> 28
<211> 87
<212> PRT
<213> Chlamydia pneumoniae

```

```

<400> 28
Met Ser Gln Lys Asn Lys Asn Ser Ala Phe Met His Pro Val Asn Ile
 1                5                10                15
Ser Thr Asp Leu Ala Val Ile Val Gly Lys Gly Pro Met Pro Arg Thr
                20                25                30
Glu Ile Val Lys Lys Val Trp Glu Tyr Ile Lys Lys His Asn Cys Gln
                35                40                45
Asp Gln Lys Asn Lys Arg Asn Ile Leu Pro Asp Ala Asn Leu Ala Lys
 50                55                60
Val Phe Gly Ser Ser Asp Pro Ile Asp Met Phe Gln Met Thr Lys Ala
65                70                75                80
Leu Ser Lys His Ile Val Lys
                85

```

```

<210> 29
<211> 369
<212> DNA
<213> Chlamydia pneumoniae

```

```

<400> 29
atgccacgca tcattggaat tgatattcct gcaaagaaaa agttaaaaat aagtctgaca      60
tatatttatg gaataggatc agctcgttct gatgaaatca ttaaaaagtt gaagttagat      120
cctgaggcaa gagcctctga attaactgaa gaagaagtag gacgactgaa ctctctgcta      180
caatcagaat ataccgtaga aggggatttg cgacgctcgtg ttcaatcgga tatcaaaaga      240
ttgatcgcca tccattctta tcgaggtcag agacatagac tttctttacc agtaagagga      300
caacgtacaa aaactaattc tcgtactcga aaaggtaaaa gaaaaacagt cgcaggtaag      360
aagaaataa                                     369

```

```

<210> 30
<211> 122
<212> PRT

```

<213> Chlamydia pneumoniae

<400> 30

```

Met Pro Arg Ile Ile Gly Ile Asp Ile Pro Ala Lys Lys Lys Leu Lys
 1           5           10           15
Ile Ser Leu Thr Tyr Ile Tyr Gly Ile Gly Ser Ala Arg Ser Asp Glu
           20           25           30
Ile Ile Lys Lys Leu Lys Leu Asp Pro Glu Ala Arg Ala Ser Glu Leu
           35           40           45
Thr Glu Glu Glu Val Gly Arg Leu Asn Ser Leu Leu Gln Ser Glu Tyr
 50           55           60
Thr Val Glu Gly Asp Leu Arg Arg Arg Val Gln Ser Asp Ile Lys Arg
 65           70           75           80
Leu Ile Ala Ile His Ser Tyr Arg Gly Gln Arg His Arg Leu Ser Leu
           85           90           95
Pro Val Arg Gly Gln Arg Thr Lys Thr Asn Ser Arg Thr Arg Lys Gly
           100          105          110
Lys Arg Lys Thr Val Ala Gly Lys Lys Lys
           115           120

```

<210> 31

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in the lab

<400> 31

```

Cys Ser Phe Ile Gly Gly Ile Thr Tyr Leu
 1           5           10

```

<210> 32

<211> 53

<212> PRT

<213> Chlamydia trachomatis

<400> 32

```

Leu Cys Val Ser His Lys Arg Arg Ala Ala Ala Ala Val Cys Ser Phe
 1           5           10           15
Ile Gly Gly Ile Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile
           20           25           30
Leu Phe Val Asn Lys Met Leu Ala Gln Pro Phe Leu Ser Ser Gln Thr
           35           40           45
Lys Ala Asn Met Gly
 50

```

<210> 33

<211> 161

<212> DNA

<213> Chlamydia trachomatis

<400> 33

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atctttgtgt gtctcataag cgcagagcgg ctgcggctgt ctgtagcatc atcggaggaa      60
ttacctacct cgcgacattc ggagctatcc gtccgattct gtttgtcaac aaaatgctgg      120
caaaaccggt tctttcttcc caaactaaag caaatatggg a                          161

```

<210> 34



<211> 53  
 <212> PRT  
 <213> Chlamydia trachomatis

<400> 34  
 Leu Cys Val Ser His Lys Arg Arg Ala Ala Ala Val Cys Ser Ile  
 1 5 10 15  
 Ile Gly Gly Ile Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile  
 20 25 30  
 Leu Phe Val Asn Lys Met Leu Ala Lys Pro Phe Leu Ser Ser Gln Thr  
 35 40 45  
 Lys Ala Asn Met Gly  
 50

<210> 35  
 <211> 55  
 <212> DNA  
 <213> Chlamydia pneumoniae

<400> 35  
 gatatacata tgcatacaca tcaccatcac atgagtcaaa aaaaataaaa actct 55

<210> 36  
 <211> 33  
 <212> DNA  
 <213> Chlamydia pneumoniae

<400> 36  
 ctcgaggaat tcttatttta caatatgttt gga 33

<210> 37  
 <211> 53  
 <212> DNA  
 <213> Chlamydia pneumoniae

<400> 37  
 gatatacata tgcatacaca tcaccatcac atgccacgca tcattggaat gat 53

<210> 38  
 <211> 30  
 <212> DNA  
 <213> Chlamydia pneumoniae

<400> 38  
 ctcgaggaat tcttatttct tcttacctgc 30

<210> 39  
 <211> 16  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Made in the lab

<400> 39  
 Lys Arg Asn Ile Asn Pro Asp Asp Lys Leu Ala Lys Val Phe Gly Thr  
 1 5 10 15

<210> 40  
 <211> 16  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> made in the lab

<400> 40  
 Lys Arg Asn Ile Leu Pro Asp Ala Asn Leu Ala Lys Val Phe Gly Ser  
 1 5 10 15

<210> 41  
 <211> 15  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> made in the lab

<400> 41  
 Lys Glu Tyr Ile Asn Gly Asp Lys Tyr Phe Gln Gln Ile Phe Asp  
 1 5 10 15

<210> 42  
 <211> 16  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> made in the lab

<400> 42  
 Lys Lys Ile Ile Ile Pro Asp Ser Lys Leu Gln Gly Val Ile Gly Ala  
 1 5 10 15

<210> 43  
 <211> 15  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> made in the lab

<400> 43  
 Lys Lys Leu Leu Val Pro Asp Asn Asn Leu Ala Thr Ile Ile Gly  
 1 5 10 15

<210> 44  
 <211> 509  
 <212> DNA  
 <213> Chlamydia

<400> 44  
 ggagctcgaa ttcggcacga gagtgcctat tgttttgcag gctttgtctg atgatatcgga 60  
 taccgtacgt gagattgctg tacaagtagc tgttatgtat ggttctagtt gcttactgcg 120  
 cgccgtgggc gatttagcga aaaatgattc ttctattcaa gtacgcacatca ctgcttatcg 180

```

tgctgcagcc gtgttggaga tacaagatct tgtgcctcat ttacgagttg tagtccaaaa 240
tacacaatta gatggaacgg aaagaagaga agcttggaga tctttatgtg ttcttactcg 300
gcctcatagt ggtgtattaa ctggcataga tcaagcttta atgacctgtg agatgttaaa 360
ggaatatcct gaaaagtgtg cggaagaaca gattcgtaga ttattggctg cagatcatcc 420
agaagtgcag gtagctactt tacagatcat tctgagagga ggtagagtat tccggtcatc 480
ttctataatg gaatcggttc tcgtgccgg 509

```

<210> 45  
 <211> 481  
 <212> DNA  
 <213> Chlamydia

<220>  
 <221> unsure  
 <222> (23)  
 <223> n=A,T,C or G

```

<400> 45
gatccgaatt cggcacgagg cantatcttac tcccaacatt acggttccaa ataagcgata 60
aggtcttcta ataaggaagt taatgtaaga ggcttttcta ttgcttttcg taaggtagta 120
ttgcaaccgc acgcgattga atgatacgca agccatttcc atcatggaaa agaacccttg 180
gacaaaaata caaaggaggt tcaactcctaa ccagaaaaag ggagagttag tttccatggg 240
ttttccttat atacacccgt ttcacacaat taggagccgc gtctagtatt tggaatacaa 300
attgtcccca agcgaatttt gttcctgttt cagggatttc tctaattgt tctgtcagcc 360
atccgcctat ggtaacgcaa ttagctgtag taggaagatc aactccaaac aggtcataga 420
aatcagaaag ctcataggtg cctgcagcaa taacaacatt cttgtctgag tgagcgaatt 480
g 481

```

<210> 46  
 <211> 427  
 <212> DNA  
 <213> Chlamydia

<220>  
 <221> unsure  
 <222> (20)  
 <223> n=A,T,C or G

```

<400> 46
gatccgaatt cggcacgagn tttttcctgt tttttcttag tttttagtgt tcccgagaca 60
ataacacaga tcaaagaacg gccattcagt ttaggctctg actcaacaaa acctatgtcc 120
tctaagccct gacacattct ttgaacaacc ttatgccctg gttcgggata agccaactct 180
cgcccccgaa acatacaaga aacctttact ttatttcctt tctcaataaa ggctctagct 240
tgctttgctt tcgtaagaaa gtcgttatca tcgatattag gcttaagctt aacctctttg 300
atacgcactt ggtgctgtgc tttcttacta tctttttcct ttttagttat gtcgtaacga 360
tacttcccgt agtccatgat tttgcacaca ggaggctctg agtttgaagc aacctcgtgc 420
cgaattc 427

```

<210> 47  
 <211> 600  
 <212> DNA  
 <213> Chlamydia

<220>  
 <221> unsure  
 <222> (522)  
 <223> n=A,T,C or G

&lt;400&gt; 47

```

gatccgaatt cggcacgaga tgcttctatt acaattgggtt tggatgcgga aaaagcttac 60
cagcttattc tagaaaagtt gggagatcaa attcttgggtg gaattgctga tactattggt 120
gatagtacag tccaagatat tttagacaaa atcacacag acccttctct aggtttgttg 180
aaagctttta acaactttcc aatcactaat aaaattcaat gcaacgggtt attcactccc 240
aggaacattg aaactttatt aggaggaact gaaataggaa aattcacagt cacacccaaa 300
agctctggga gcatgttctt agtctcagca gatattattg catcaagaat ggaaggcggc 360
gttgttctag ctttggtacg agaagggtgat tctaagccct acgcgattag ttatggatac 420
tcatcaggcg ttcctaattt atgtagtcta agaaccagaa ttattaatac aggattgact 480
ccgacaacgt attcattacg tgtaggcggg ttagaaagcg gngtggtatg ggtaaatgcc 540
ctttctaattg gcaatgatat ttttaggaata acaaatcttc taatgtatct tttttggagg 600

```

&lt;210&gt; 48

&lt;211&gt; 600

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 48

```

ggagctcgaa ttccggcacga gctctatgaa tatccaattc tctaaactgt tcggataaaa 60
atgatgcagg aattagggtc acactatctt tttttgttgc gcaaatgatt gattttaaat 120
cgtttgatgt gtatactatg tcgtgtaagc ctttttggtt actctcgaca ctaccccca 180
atccagaaga taaattggat tgcgggtcta ggtagcaag taacactttt tccctaaaa 240
attgggccaa gttgcatccc acgttttagag aaagtgttgt tttccagtt cctcccttaa 300
aagagcaaaa aactaagggtg tgcaaatcaa ctccaacgtt agagtaagtt atctattcag 360
ccttgaaaaa catgtctttt ctagacaaga taagcataat caaagccttt tttagcttta 420
aactgttatc ctctaatttt tcaagaacag gagagtctgg gaataatcct aaagagtttt 480
ctatttggtg aagcagtcct agaattagtg agacactttt atggtagagt tctaaggagg 540
aatttaagaa agttactttt tccttgttta ctcgatttt taggtctaata tcggggaaat 600

```

&lt;210&gt; 49

&lt;211&gt; 600

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 49

```

gatccgaatt cggcacgaga tgcttctatt acaattgggtt tggatgcgga aaaagcttac 60
cagcttattc tagaaaagtt gggagatcaa attcttgggtg gaattgctga tactattggt 120
gatagtacag tccaagatat tttagacaaa atcacacag acccttctct aggtttgttg 180
aaagctttta acaactttcc aatcactaat aaaattcaat gcaacgggtt attcactccc 240
aggaacattg aaactttatt aggaggaact gaaataggaa aattcacagt cacacccaaa 300
agctctggga gcatgttctt agtctcagca gatattattg catcaagaat ggaaggcggc 360
gttgttctag ctttggtacg agaagggtgat tctaagccct acgcgattag ttatggatac 420
tcatcaggcg ttcctaattt atgtagtcta agaaccagaa ttattaatac aggattgact 480
ccgacaacgt attcattacg tgtaggcggg ttagaaagcg gtgtggtatg ggtaaatgcc 540
ctttctaattg gcaatgatat ttttaggaata acaaatcttc ctaatgtatc ttttttggag 600

```

&lt;210&gt; 50

&lt;211&gt; 406

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 50

```

gatccgaatt cggcacgagt tcttagcttg cttaattacg taattaacca aactaaaggg 60
gctatcaaat agcttattca gtctttcatt agttaaacga tcttttctag ccatgactca 120
tctatgttct ttcagctata aaaatacttc ttaaaacttg atatgctgta atcaaatcat 180
cattaaccac aacataatca aattcgctag cggcagcaat ttcgacagcg ctatgctcta 240
atctttcttt cttctggaaa tctttctctg aatcccgagc attcaaacgg cgctcaagtt 300
cttcttgaga gggagcttga ataaaaatgt gactgccggc atttgcttct tcagagccaa 360

```

agctccctgtg acatcaatca cggctatgca gtctcgtgcc gaattc

406

<210> 51  
 <211> 602  
 <212> DNA  
 <213> Chlamydia

<400> 51  
 gatccgaatt cggcacgaga tat t t t t tagac aaaatcacaa cagacccttc tctagg t t t g 60  
 ttgaaa g c t t t t a a c a a c t t t c c a a t c a c t a a t a a a a t t c a a t g c a a c g g g t t a t t c a c t 120  
 c c c a g g a a c a t t g a a a c t t t a t t a g g a g g a a c t g a a a t a g g a a a a t t c a c a g t c a c a c c c 180  
 a a a a g c t c t g g g a g c a t g t t c t a g t c t c a g c a g a t a t t a t t g c a t c a a g a a t g g a a g g c 240  
 g g c g t t g t t c t a g c t t t g g t a c g a g a a g g t g a t t c t a a g c c t a c g c g a t t a g t t a t g g a 300  
 t a c t c a t c a g g c g t t c c t a a t t t a t g t a g t c t a a g a a c c a g a a t t a t a a t a c a g g a t t g 360  
 a c t c c g a c a a c g t a t t c a t t a c g t g t a g g c g g t t t a g a a a g c g g t g t g g t a t g g g t t a a t 420  
 g c c c t t t c t a t g g c a a t g a t a t t t t a g g a a t a a c a a a t a c t t c t a a t g t a t c t t t t t t g 480  
 g a g g t a a t a c c t c a a a c a a a c g c t t a a a c a a t t t t t a t t g g a t t t t t c t t a t a g g t t t t a 540  
 t a t t t a g a g a a a a a g t t c g a a t t a c g g g g t t t g t t a t g c a a a a a a a c t c g t g c c g a a t 600  
 t c 602

<210> 52  
 <211> 145  
 <212> DNA  
 <213> Chlamydia

<400> 52  
 gatccgaatt cggcacgagc t c g t g c c g a t g t g t t c a a c a g c a t c c a t a g g a t g g g c a g t 60  
 c a a a t a t a c t c c a a g t a a t t c t t t t t c t c t t t t c a a c a c t c c t t a g g a g a g c g t t g g a t 120  
 a a c a t t t t c a g c t c g t g c c g a a t t c 145

<210> 53  
 <211> 450  
 <212> DNA  
 <213> Chlamydia

<400> 53  
 gatccgaatt cggcacgagg t a a t c g g c a c c g c a c t g c t g a c a c t c a t c t c c t c g a g c t c 60  
 g a t c a a a c c c a c a c t t g g g a c a a g t a c c t a c a a c a t a a c g g t c c g c t a a a a a c t t c c c t t 120  
 c t t c c t c a g a a t a c a g c t g t t c g g t c a c c t g a t t c t c a c a g t c c g c g t t c c t g c a a g t 180  
 t t c g a t a g a a a t c t t t g c a c a a t a g c a g g a t g a t a a g c g t t c g t a g t t c t g g a a a g a a a t 240  
 c t a c a g a a a t t c c c a a t t t c t t g a a g g t a t c t t t a t g a a g c t t a t g a t a c a t g t c g a c a t 300  
 a t t c t t g a t a c c c a t g c c t g c c a a c t c t g c a t t a a g g g t a a t t g c g a t t c c g t a t t c a t 360  
 c a g a a c c a c a a a t a t a c a a a a c c t c t t t t g c c t t g t a g t c t c t g a a a a c g c g c a t a a a c a t 420  
 c t g c a g g c a a a t a a g c c t c g t g c c g a a t t c 450

<210> 54  
 <211> 716  
 <212> DNA  
 <213> Chlamydia

<400> 54  
 gatcgaaatt cggcacgagc g g c a c g a g t t t t c t g a t a g c g a t t t a c a a t c c t t t a t t c a 60  
 a c t t t t g c c t a g a g g g c a c a c t a t a c t a a g a a g t t t c t t g g g t g t g t g c a c a g t c c t g 120  
 t c g t c a g g g g a t t c t g c t a g a g g g g t a g g g g a a a a a c c c t t a t t a c t a t g a c c a t g c g c 180  
 a t g t g g a a t t a c t t c c a t a g a c t t t c g c a t c a t t c c c a c a t t t a c a c a g c t c t a c a c c 240  
 t c t t a a g a a g a g g t g a c g t g g a t t g a t t g g g t g g g c a g c c t t g g c a c c a a g g g a t t c c t t t t g 300  
 a g c t t c g g a c t a c c t c t g c t c t c t a c a c c c a t t a c c c t g t a g a t g g c a c a t t c t g g c t t a 360  
 t t c t t a a t c c c a a a g a t c c t g t a c t t t t c c t c t c t a t c t a a t c g t c a g c g a t t g a t t g c t g 420

```

ccatccaaaa ggaaaaactg gtgaagcaag ctttaggaac acaatatcga gtagctgaaa 480
gctctccatc tccagaggga atcatagctc atcaagaagc ttctactcct ttctctggga 540
aaattacttt gatataatccc aataatatta cgcgctgtca gcgtttggcc gaggtatcca 600
aaaaatgatc gacaaggagc acgctaaatt tgtacatacc ccaaaatcaa tcagccatct 660
aggcaaatgg aatatcaaag taaacagtat acaactgggg atctcgtgcc gaattc 716

```

&lt;210&gt; 55

&lt;211&gt; 463

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 55

```

tctcaaatcc ttgctttgaa taatccagat atttcaaaaa ccatgttcga taaattcacc 60
cgacaaggac tccgtttcgt actagaagcc tctgtatcaa atattgagga tataggagat 120
cgcgttcggt taactatcaa tgggaatgtc gaagaatacg attacgttct cgtatctata 180
ggacgccggt tgaatacaga aaatatgtgc ttggataaag ctgggtgttat ttgtgatgaa 240
cgcggagtca tccctaccga tgccacaatg cgcacaaacg tacctaacat ttatgctatt 300
ggagatatca caggaaaatg gcaacttgcc catgtagctt ctcacaaagg aatcattgca 360
gcacgggaata taggtggcca taaagaggaa atcgattact ctgctgtccc ttctgtgatc 420
ttaccttcc ctgaagtcgc ttcagtaggc ctctcccaa cag 463

```

&lt;210&gt; 56

&lt;211&gt; 829

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 56

```

gtactatggg atcattagtt ggaagacagg ctccggatth ttctggtaaa gccgttgtht 60
gtggagaaga gaaagaaatc tctctagcag actttcgtgg taagtatgta gtgctcttct 120
ttatcctaa agatthtacc tatgtttgtc ctacagaatt acatgcttht caagatagat 180
tggtagatth tgaagagcat ggtgcagtcg tcttgggtg ctccgttgac gacattgaga 240
cacattctcg ttggctcact gtagegagag atgcaggagg gatagaggga acagaatatt 300
ctctgttagc agaccctct tttaaaatat cagaagctth tgggtgttht aatcctgaag 360
gatcgctcgc ttttaagagct actttcctta tgcataaaca tgggggttatt cgtcatgcgg 420
ttatcaatga tcttctctta gggcgthtcca ttgacgagga attgcgtatt ttagattcat 480
tgatcttctt tgagaaccac ggaatggtth gtccagctaa ctggcgthtct ggagagcgtg 540
gaatggtgcc tctgaagag ggattaaaag aatacttcca gacgatggat taagcatctt 600
tgaagtagaag aaagtcgtac agatcttgat ctgaaaagag aagaaggctt ttaatttht 660
tgcagagagc cagcgaggct tcaataatgt tgaagtctcc gacaccaggc aatgctaagg 720
cgacgatatt agttagtga gtctgagtat taaggaaatg aaggccaaag aaatagctat 780
caataaagaa gccttcttcc ttgactctaa agaatagtat gtcgtatcc 829

```

&lt;210&gt; 57

&lt;211&gt; 1537

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 57

```

acatcaagaa atagcggact cgcctttagt gaaaaaagct gaggagcaga ttaatcaagc 60
acaacaagat attcaaagca tcacacctag tggthtggat attcctatcg ttggtccgag 120
tgggtcagct gcttccgcag gaagtgcggc aggagcgttg aaatcctcta acaattcagg 180
aagaatthtcc ttgttgcttg atgatgtaga caatgaaatg gcagcgattg caatgcaagg 240
thttcgatct atgatcgaa aatthaatgt aaacaatcct gcaacagcta aagagctaca 300
agctatggag gctcagctga ctgcgatgtc agatcaactg gthggtgcgg atggcgagct 360
cccagccgaa atacaagcaa tcaaagatgc tcttgcgcaa gctthtgaac aacctcagc 420
agatggthtta gctacagcta tgggacaagt ggctthtgc gctgccaagg ttggaggagg 480
ctccgcagga acagctggca tgggtccagat gaatgtaaaa cagctthtaca agacagcgtt 540
thttctgact tcttccagct cttatgcagc agcactthtcc gatggatatt ctgcttaca 600

```

```

aacactgaac tctttatatt ccgaaagcag aagcggcgtg cagtcagcta ttagtcaaac 660
tgcaaatccc gcgctttcca gaagcgtttc tcgttctggc atagaaagtc aaggacgcag 720
tgcatatgct agccaaagag cagcagaaac tattgtcaga gatagccaaa cgtaggtga 780
tgtatatagc cgcttacagg ttctggattc tttgatgtct acgattgtga gcaatccgca 840
agcaaatcaa gaagagatta tgcagaagct cacggcatct attagcaaag ctccacaatt 900
tggttatcct gctgttcaga attctgtgga tagcttgagc aagtttgctg cacaattgga 960
aagagagttt gttgatgggg aacgtagtct cgcagaatct caagagaatg cgtttagaaa 1020
acagcccgcg ttcattcaac aggtgttggg aaacattgct tctctattct ctggttatct 1080
ttcttaacgt gtgattgaag tttgtgaatt gagggggagc caaaaaagaa tttctttttt 1140
ggctcttttt tcttttcaaa ggaatctcgt gtctacagaa gtcttttcaa taataagttc 1200
ttagttccaa aagaagaaaa tatataaaag aaaaaactcc taattcattt aaaagtgtc 1260
cggcagactt cgtggaaaaat gtctgtaaaag ctggagggga atcagcagaa agatgcaaga 1320
tatccgagaa aaaaggctca ggctcgtgcc gaattcggca cgagactacg aaagaaagggt 1380
cttttctttc ggaatctgtc attggatctg cgtaagactt aaagttcggc aacacaggct 1440
ctgtcttctc ttttaggtttc ttgcgcgaga aaaattttct caagtaacaa gaagatttct 1500
ttttacagcc ggcattccggc ttctcgcgaa gtataac 1537

```

&lt;210&gt; 58

&lt;211&gt; 463

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 58

```

tctcaaatcc ttgctttgaa taatccagat atttcaaaaa ccatgttcga taaattcacc 60
cgacaaggac tccgtttcgt actagaagcc tctgtatcaa atattgagga tataggagat 120
cgcgttcggt taactatcaa tgggaatgtc gaagaatacg attacgttct cgtatctata 180
ggacgcggtt tgaatacaga aaatattggc ttggataaag ctggtgttat ttgtgatgaa 240
cgcggagtca tccctaccga tgccacaatg cgcacaaacg tacctaacat ttatgctatt 300
ggagatatca caggaaaatg gcaacttgcc catgtagctt ctcataagg aatcattgca 360
gcacggaata taggtggcca taaagaggaa atcgattact ctgctgtccc ttctgtgata 420
tttaccttcc ctgaagtgcg ttcagtaggc ctctcccaaa cag 463

```

&lt;210&gt; 59

&lt;211&gt; 552

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 59

```

acattcctcc tgctcctcgc ggccatccac aaattgaggt aaccttcgat attgatgcca 60
acggaatttt acacgtttct gctaaagatg ctgctagtgg acgcgaacaa aaaatccgta 120
ttgaagcaag ctctggatta aaagaagatg aaattcaaca aatgatccgc gatgcagagc 180
ttcataaaga ggaagacaaa caacgaaaag aagcttctga tgtgaaaaat gaagccgatg 240
gaatgatctt tagagccgaa aaagctgtga aagattacca cgacaaaatt cctgcagaac 300
ttgttaaaga aattgaagag catattgaga aagtacgcca agcaatcaaa gaagatgctt 360
ccacaacagc tatcaaagca gcttctgatg agttgagtag tcgtatgcaa aaaatcggag 420
aagctatgca ggctcaatcc gcattccgag cagcatcttc tgcagcgaat gctcaaggag 480
ggccaaacat taactccgaa gatctgaaaa aacatagttt cagcacacga cctocagcag 540
gaggaagcgc ct 552

```

&lt;210&gt; 60

&lt;211&gt; 1180

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 60

```

atcctagcgg taaaactgct tactgggtcag ataaaaatcca tacagaagca acacgtactt 60
cttttaggag aaaaaatcta taatgctaga aaaatcctga gtaaggatca cttctcctca 120
acaacttttt catcttggat agagttagtt tttagaacta agtcttctgc ttacaatgct 180

```

```

cttgcattatt acgagcttttt tataaacctc cccaacccaa ctctacaaaa agagtttcaa 240
tcgatccctt ataatccgc atatattttg gccgctagaa aaggcgattt aaaaaccaag 300
gtcgatgtga tagggaaagt atgtggaatc tcgtgccgaa ttcggcacga gcggcacgag 360
gatgtagagt aattagttaa agagctgcat aattatgaca aagcatggaa aacgcattcg 420
tggatccaa gagacttacg atttagctaa gtctattctt ttgggtgaag cgatagatat 480
tttaaaacag tgcctactg tgcgtttoga tcaaaccggt gatgtgtctg ttaaattagg 540
gatcgatcca agaaagagt atcagcaaat tcgtggttcg gtttctttac ctcacggtac 600
aggtaaaagt ttgcgaattt tagtttttgc tgctggagat aaggctgcag aggctattga 660
agcaggagcg gactttgttg gttagcgacg cttggtagaa aaaatcaaa gtggatgggt 720
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agtttttagt ccaagaaacc ttatgcctac gcctaaagcc ggaactgtaa caacagatgt 840
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tgtatgcaac gtgcgagttg cgaagctttc ttctgatagt gcgcaaatca aagaaaatgt 960
tgaagcgttg tgtgcagcct tagttaaagc taagcccgc actgctaaag gacaatattt 1020
agttaatctt actatttctt cgaccatggg gccaggggtt accgtggata ctaggaggtt 1080
gattgcgtta taattctaag tttaaagagg aaaaatgaaa gaagagaaaa agttgctgct 1140
tcgcgaggtt gaagaaaaga taaccgcttc tcggcacgag 1180

```

&lt;210&gt; 61

&lt;211&gt; 1215

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 61

```

attacagcgt gtgcaggtaa cgacatcatt gcatgatgct tttgatggca ttgatgcggc 60
attccttata gggtcagttc ctagaggccc aggaatggag agaagagatc ttctaaagaa 120
aaatggggag attgttgcta cgcaaggaaa agctttgaac acaacagcca agcgggatgc 180
aaagattttt gttgttggga accctgtgaa taccaattgc tggatagcaa tgaatcatgc 240
tcccagatta ttgagaaaaga actttcatgc gatgctacga ttggaccaga atcgatgca 300
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tatcgagag acgatagcgg atcgtgattg gttagagaat attatggtgc cttctgtaca 480
gagtcgtggt agtgagtaa ttgaagcac agggagctt tcggcagctt ctgcagcacg 540
agcttttagca gaggtgctc gatcaatata tcagccaaaa gaaggactcg tgccgaattc 600
ggcacgagta tcgaaattgc aggcatttct agtgaatggt cgtatgctta taaactacgt 660
ggtacagact tgagctctca aaagtgtgct acagattctt acatcgcaga cccttattct 720
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actcttgtca aagcgttaca ccgtgcggga atcgaaagtc ttctcgatgt cgttttcaat 1200
catacaggct ttgaa 1215

```

&lt;210&gt; 62

&lt;211&gt; 688

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 62

```

gtggatccaa aaaagaatct aaaaagccat acaaagattg cgttacttct tgcgatgcct 60
ctaacacttt atcagcgtca tctttgagaa gcatctcaat gagcgtttt tcttctctag 120
catgcgcgac atccgcttct tcatgttctg tgaaatatgc atagtcttca ggattggaaa 180
atccaaagta ctcatgcaat ccacgaattt tctctctagc gatacgtgga atttgactct 240
cataagaata caaagcagcc actcctgcag ctaaagaatc tcctgtacac caccgcatga 300
aagtagctac ttctgctttt gctgcttcac taggtctcat agcctctaac tcttctggag 360

```



```

taactcctag agcaaacaca aactgcttcc acaaatcaat atgattaggg taaccgttct 420
cttcatccat caagttatct aacaataact tacgcgcctc taaatcatcg caacgactat 480
gaatcgacaga taaatattta ggaaaggctt tgatatgtaa ataatagtct ttggcacgag 540
cctgtaattg ctcttttagta agctccccct tcgaccattt cacataaaac gtgtgttcta 600
gcatatgctt attttgaata attaaatcta actgatctaa aaaattcata aacacctcca 660
tcatttcttt tcttgactcc acgtaacc                                     688

```

&lt;210&gt; 63

&lt;211&gt; 269

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 63

```

atgttgaaat cacacaagct gttcctaaat atgctacggt aggatctccc tatcctgttg 60
aaattactgc tacaggtaaa agggattgtg ttgatgttat cattactcag caattaccat 120
gtgaagcaga gttcgtacgc agtgatccag cgacaactcc tactgctgat ggtaagctag 180
tttgaaaaat tgaccgctta ggacaaggcg aaaagagtaa aattactgta tgggtaaaac 240
ctcttaaaga aggttgctgc tttacagct                                     269

```

&lt;210&gt; 64

&lt;211&gt; 1339

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 64

```

cttttattat ggcttctggg gatgatgtca acgatatcga cctgctatct cgaggagatt 60
ttaaaattgt tatacagacg gctccagagg agatgcatgg attagcggac tttttggctc 120
ccccggcgaa ggatcttggg attctctccg cctgggaagc tggtagctg cgttacaaac 180
agctagttaa tccttaggaa acatttctgg acctatgcc atcacattgg ctccgtgac 240
cacatagaga gtttctcccg taattgctgt agctagggga gagactaaga aggtgctgc 300
tgcgctact tgctcagctt ccattggaga aggtagtggg gccagtcctt ggtagtaatc 360
caccattctc tcaataaatc caatagcttt tctgcacgg ctagctaatt gccctgccga 420
gatagtattc actcggactc cccaacgtcg gccggcttcc caagccagta cttttgtatc 480
actttctaaa gcagcttttg ctgcgttcat tcctccgcca taccctggaa cagcacgcat 540
ggaagcaaga taagttagag agatgggtgt agctcctgca ttcataattg ggccaaaatg 600
agagagaagg ctgataaagg agtagctgga tgtacttaag gggcaagat agcctttacg 660
agaggtatca agtaatggtt tagcaatttc cggactgttt gctaaagagt gaacaagaat 720
atcaatgtgt ccaaaatctt ttttoacctg ttctacaact tcggatacag tgtaccacaga 780
aagatctttg taacgtttat tttccaaaat ttctgagga atatcttctg ggtgtcgaa 840
actggcatcc atgggtaga ttttagcgaa agttagcaat tctccattgg agagttcacg 900
agatgcattg aattttccta actcccaaga ttgagagaaa attttataga taggaacca 960
ggtccccaca agtatgggtg cgcctgcttc tgctaacatt ttggcaatgc ccagccata 1020
cccggttatca tcgcctatgc cggttatgaa agcaattttt cctgttaaat caattttcaa 1080
catgagctaa ccccatthtg tcttcttgag agaggagagt agcagattct ttattattga 1140
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aaagagtttc cttgtcaaat tcttatatgg gtagagttaa tcaactgttt tcaagtgatt 1260
tatgtttatt ttaaaataat ttgttttaac aactgtttaa tagttttaat ttttaaagtg 1320
tgaaaaacag gttttatat                                     1339

```

&lt;210&gt; 65

&lt;211&gt; 195

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 65

Met Gly Ser Leu Val Gly Arg Gln Ala Pro Asp Phe Ser Gly Lys Ala

5

10

15

Val Val Cys Gly Glu Glu Lys Glu Ile Ser Leu Ala Asp Phe Arg Gly  
                   20                  25                  30  
 Lys Tyr Val Val Leu Phe Phe Tyr Pro Lys Asp Phe Thr Tyr Val Cys  
                   35                  40                  45  
 Pro Thr Glu Leu His Ala Phe Gln Asp Arg Leu Val Asp Phe Glu Glu  
                   50                  55                  60  
 His Gly Ala Val Val Leu Gly Cys Ser Val Asp Asp Ile Glu Thr His  
                   65                  70                  75                  80  
 Ser Arg Trp Leu Thr Val Ala Arg Asp Ala Gly Gly Ile Glu Gly Thr  
                   85                  90                  95  
 Glu Tyr Pro Leu Leu Ala Asp Pro Ser Phe Lys Ile Ser Glu Ala Phe  
                   100                  105                  110  
 Gly Val Leu Asn Pro Glu Gly Ser Leu Ala Leu Arg Ala Thr Phe Leu  
                   115                  120                  125  
 Ile Asp Lys His Gly Val Ile Arg His Ala Val Ile Asn Asp Leu Pro  
                   130                  135                  140  
 Leu Gly Arg Ser Ile Asp Glu Glu Leu Arg Ile Leu Asp Ser Leu Ile  
                   145                  150                  155                  160  
 Phe Phe Glu Asn His Gly Met Val Cys Pro Ala Asn Trp Arg Ser Gly  
                   165                  170                  175  
 Glu Arg Gly Met Val Pro Ser Glu Glu Gly Leu Lys Glu Tyr Phe Gln  
                   180                  185                  190  
 Thr Met Asp  
                   195

<210> 66  
 <211> 520  
 <212> DNA  
 <213> Chlamydia

<400> 66  
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 ccattcacta gaaactccat aacagcgggt ttctctgatg gcgagtaaga agcaagcatt 120  
 tgatgtaaata tagcgcaatt agagggggat gaggttactt ggaaatataa ggagcgaagc 180  
 gatgaaggag atgtatttgc tctggaagca aaggtttctg aagctaacag aacattgcgt 240  
 cctccaacaa tcgcctgagg attctggctc atcagttgat gctttgcctg aatgagagcg 300  
 gacttaagtt tcccatcaga gggagctatt tgaattagat aatcaagagc tagatccttt 360  
 attgtgggat cagaaaattt acttgtgagc gcacgcagaa tttcgtcaga agaagaatca 420  
 tcatcgaacg aatttttcaa tcctcgaaaa tcttctccag agacttcgga aagatcttct 480  
 gtgaaacgat cttcaagagg agtatcgctt ttttcctctg 520

<210> 67  
 <211> 276  
 <212> DNA  
 <213> Chlamydia

&lt;400&gt; 67

```

gatccgaatt cggcacgagg tattgaagga gaaggatctg actcgatcta tgaaatcatg 60
atgcctatct atgaagttat gaatatggat ctagaaacac gaagatcttt tgcggtacag 120
caagggcact atcaggaccc aagagcttca gattatgacc tcccacgtgc tagcgactat 180
gatttgccca gaagcccata tcctactcca cttttgcctt ctagatatca gctacagaat 240
atggatgtag aagcagggtt ccgtgaggca gtttat 276

```

&lt;210&gt; 68

&lt;211&gt; 248

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 68

```

gatccgaatt cggcacgagg tgttcaagaa tatgtccttc aagaatgggt taaattgaaa 60
gatctaccgg tagaagagtt gctagaaaaa cgatatcaga aattccgaac gatagggtcta 120
tatgaaactt cttctgaaag cgattctgag gcataagaag catttagttt tattcggttt 180
ttctctttta tccatattag ggctaacgat aacgtctcaa gcagaaattt tttctctagg 240
tcttattg 248

```

&lt;210&gt; 69

&lt;211&gt; 715

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; unsure

&lt;222&gt; (34)

&lt;223&gt; n=A,T,C or G

&lt;400&gt; 69

```

gatccgaatt cggcacgaga aggtagatcc gatntcagca aaagtgctcc taaaggaaga 60
ttccttcggg atcctgcagc aaataaggtg gcacactcca tctcggacag tttgagcttt 120
attttcatat agttttcgac ggaactcttt attaaactcc caaaaccgaa tgtagtctgt 180
gtgggtgatg cctatatggt aagggagggt tttggcttcg agaatatggg tgatcatttt 240
ttgtacgaca aaattagcta atgcagggac ctctgggggg aagtatgcat ctgatgttcc 300
atcttttcgg atgctagcaa caggggacaaa ataatctcct atttggtagt gggatcttaa 360
gcctccgcac atgcccacaa tgatcgctgc tgtagcattg ggaaggaaag aacacagatc 420
tacggtaaga gctgctcctg gagagcctaa tttaaaatcg atgattgagg tgtgaatttg 480
aggcgcatgc gctgccgaaa acatggatcc tcgagaaaaca gggacctgat agatttcagc 540
gaaaacatcc acggtaatat ccmataattag taagaaggag atagggctgg aactcttgaa 600
tggtagagcc ggtatagcgc tctagcatgt cacaggcgat tgtttcttcg ctgatttttt 660
tatgttgatg ggtcataaat cacagatatt ataatgggta gagaatcttt ttttc 715

```

&lt;210&gt; 70

&lt;211&gt; 323

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 70

```

gatccgaatt cggcacgagc agaacgtaaa cagcacactt aaaccgtgta tgagggtttaa 60
cactgttttg caagcaaaca accattcctc tttccacatc gttcttacca atacctctga 120
ggagcaatcc aacattctct cctgcacgac cttctgggag ttcttttctg aacatttcaa 180
ccccagtaac aatcgtttct ttagtatctc taagaccgac caactgaact ttatcggaaa 240
ctttaacaat tccacgtcca atacgtccag ttactacagt tcctcgctcc gagatagaga 300
acacgtcttc aatgggcatt aag 323

```

&lt;210&gt; 71

&lt;211&gt; 715

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 71

```

gatccgaatt cggcaccgagg aaaaaaagat tctctaacca ttataatata tgtgatttat 60
gacccatcaa cataaaaaaa tcagcgaaga aacaatcgcc tgtgacatgc tagagcggct 120
ataccggctc taccattcaa gagttccagc cctatctcct tcttactaat ttgggtatt 180
acgtggatgt tttcgctgaa atctatcagg tccctgtttc tcgaggatcc atgttttcgg 240
gcagcgcatt cgcctcaaat tcacacctca atcatcgatt ttaaattagg ctctccagga 300
gcagctctta ccgtagatct gtgttctttc ctcccaatg ctacagcagc gatcatgttg 360
ggcatgtgcg gaggcttaag atcccactac caaataggag attattttgt ccctgttgct 420
agcatccgaa aagatggaac atcagatgca tacttcccc cagaggtccc tgcattagct 480
aattttgtcg tacaaaaaat gatcaccaat attctcgaag ccaaaaacct cccttaccat 540
ataggcatca cccacacgac taacattcgg ttttgggagt ttaataaaga gttccgtcga 600
aaactatatg aaaataaagc tcaaactgtc gagatggagt gtgccacctt atttgctgca 660
ggataccgaa ggaatcttcc tttaggagca cttttgctga tatcgatct acctt 715

```

&lt;210&gt; 72

&lt;211&gt; 641

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; unsure

&lt;222&gt; (550)

&lt;223&gt; n=A,T,C or G

&lt;221&gt; unsure

&lt;222&gt; (559)

&lt;223&gt; n=A,T,C or G

&lt;221&gt; unsure

&lt;222&gt; (575)

&lt;223&gt; n=A,T,C or G

&lt;221&gt; unsure

&lt;222&gt; (583)

&lt;223&gt; n=A,T,C or G

&lt;221&gt; unsure

&lt;222&gt; (634)

&lt;223&gt; n=A,T,C or G

&lt;221&gt; unsure

&lt;222&gt; (638)

&lt;223&gt; n=A,T,C or G

&lt;400&gt; 72

```

gatccgaatt cggcaccgaga tctcctcgag ctcgatcaaa cccacacttg ggacaagtac 60
ctacaacata acggtccgct aaaaacttcc cttcttcctc agaatacagc tggtcgggtca 120
cctgattctc taccagtcgg cgttcctgca agtttcgata gaaatcttgc acaatagcag 180
gatgataagc gttcgtagtt ctggaaaaga aatctacaga aattcccaat ttcttgaagg 240
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ctgcattaag ggtaattgcg attccgtatt catcagaacc acaaatatac aaaacctctt 360
tgcctttagt tctctgaaaa cgcgcataaa catctgcagg caaataagca ccggtaatat 420
gtccaaaatg caaaggacca tttgcgtaag gcaacgcaga agtaataaga atacgggaag 480
attccactat ttcacgtcgc tccagttgta cagagaagga tcttttcttc tggatgttcc 540
gaaaccttgn tctcttcgnc tctctcctgt agcanacaaa tgnctctctc gacatctctt 600
tcagcgtatt cggactgatg ccctaaagat ccnnggangt t 641

```

&lt;210&gt; 73

&lt;211&gt; 584

&lt;212&gt; DNA

<213> Chlamydia

<220>

<221> unsure

<222> (460)

<223> n=A,T,C or G

<221> unsure

<222> (523)

<223> n=A,T,C or G

<221> unsure

<222> (541)

<223> n=A,T,C or G

<221> unsure

<222> (546)

<223> n=A,T,C or G

<400> 73

```

gaattcggca cgagacattt ctagaatgga accggcaaca aacaaaaact ttgtatctga 60
agatgacttt aagcaatctt tagataggga agattttttg gaatgggtct ttttatttgg 120
gacttattac ggaacgagta aggcggagat ttctagagtt ctgcaaaagg gtaagcactg 180
catagccgtg attgatgtac aaggagcttt ggctctgaag aagcaaatgc cggcagtcac 240
tatttttatt caagctccct ctcaagaaga acttgagcgc cgtttgaatg ctccgggattc 300
agagaaagat ttccagaaga aagaaagatt agagcatagc gctgtcgaaa ttgctgccgc 360
tagcgaattt gattatgttg tggttaatga tgatttgatt acagcatatc aagttttaag 420
aagtattttt atagctgaag aacataggat gagtcatggn tagaaaagat cgtttaacta 480
atgaaagact gaataagcta tttgatagcc cctttagttt ggntaattac gtaattaagc 540
nagctnagaa caaaattgct agaggagatg ttctgtcttc taac 584

```

<210> 74

<211> 465

<212> DNA

<213> Chlamydia

<400> 74

```

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taagaaatta ttttcgagtg aaagagctag gcgtaatcat tacagatagc catactactc 120
caatgcggcg tggagtactg ggtatcgggc tgtgttggtg tggattttct ccattacaca 180
actatatagg atcgctagat tgtttcggtc gtcccttaca gatgacgcaa agtaatcttg 240
tagatgcctt agcagttgctg gctgtttgtt gtatgggaga ggggaatgag caaacaccgt 300
tagcgggtgat agagcaggca cctaatatgg tctaccatc atatcctact tctcgagaag 360
agtattgttc tttgcgcata gatgaaacag aggacttata cggacctttt ttgcaagcgg 420
ttaccgtgga gtcaagaaaa gaaatgatgg aggtgtttat gaatt 465

```

<210> 75

<211> 545

<212> DNA

<213> Chlamydia

<400> 75

```

gaattcggca cgagatgaaa agttagcgtc acaggggatt ctctaccaa agaattccga 60
aaagttttct tccaaaaacc tcttctctc ttgattagtg atccctctgc aactacttta 120
ctatatgttc tgtgaaatat gcatagtctt caggattgga aaatccaaag tactcagtca 180
atccaagaat tttctcteta gcgatacgtg gaatttgact ctcataagaa tacaaagcag 240
ccactcctgc agctaaagaa tctcctgtac accaccgcgt gaaagtagct acttctgctt 300
ttgctgcttc actaggctca tgagcctcta actcttctgg agtaactcct agagcaaaca 360
caaactgctt ccacaaatca atatgattag ggtaaccgtt ctcttcatcc atcaagttat 420
ctaacaataa cttacgcgcc tctaaatcat gcgaacgact atgaatcgca gataaatatt 480
taggaaaggc tttgatatgt aaataatagt ctttggcata cgctgtaat tgctctttag 540

```

taagc

545

&lt;210&gt; 76

&lt;211&gt; 797

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; unsure

&lt;222&gt; (788)

&lt;223&gt; n=A,T,C or G

&lt;221&gt; unsure

&lt;222&gt; (789)

&lt;223&gt; n=A,T,C or G

&lt;400&gt; 76

```

gatccgaatt cggcaccgaga tacgctagat gcgataaatg cggataatga ggattatcct 60
aaaccagggtg acttcccacg atcttccttc tctagtacgc ctccctcatgc tccagtacct 120
caatctgaga ttccaacgtc acctacctca acacagcctc catcacccta acttgtaaaa 180
actgtaataa aaagagcgcg ctccctttat gcaaaatcaa tttgaacaac tccttactga 240
attagggact caaatcaaca gccctcttac tcctgattcc aataatgcct gtatagtctg 300
ctttggatac aacaatgttg ctgtacaaat tgaagaggat ggtaattcag gatttttagt 360
tgctggagtc atgcttggaa aacttccaga gaataccttt agacaaaaaa ttttcaaagc 420
tgctttgtct atcaatggat ctccgcaatc taatattaaa ggcactctag gatacggatga 480
aatctctaac caactctatc tctgtgatcg gcttaacatg acctatctaa atggagaaaa 540
gctcgcccggt tacttagttc ttttttcgca gcatgccaat atctggatgc aatctatctc 600
aaaaggagaa cttccagatt tacatgctct aggtatgtat cacctgtaaa ttatgccgtc 660
attatcccaa tcccgcagta tcatccagca atcttccatt cgaaagattt ggaatcagat 720
agatacttct cctaagcatg ggggtatgcg taccggttat ttttctcttc atactcaaaa 780
aaagttgnng gggaata                                     797

```

&lt;210&gt; 77

&lt;211&gt; 399

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 77

```

catatgcata accatcacca tcacatgcc a cgcattcttg gaattgatat tcttgcaaa 60
aaaaagttaa aaataagtct gacatatatt tatggaatag gatcagctcg ttctgatgaa 120
atcattaaaa agttgaagtt agatcctgag gcaagagcct ctgaattaac tgaagaagaa 180
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cgtgttcaat cggatatcaa aagattgatc gccatccatt cttatcgagg tcagagacat 300
agactttctt taccagtaag aggacaacgt acaaaaacta attctcgtac tcgaaaaggt 360
aaaagaaaaa cagtcgcagg taagaagaaa taagaattc                                     399

```

&lt;210&gt; 78

&lt;211&gt; 285

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 78

```

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gtgaatatatt ccacagattt agcagttata gttggcaagg gacctatgcc cagaaccgaa 120
attgtaaaga aagtttggga atacattaaa aaacacaact gtcaggatca aaaaaataaa 180
cgtaatatcc ttcccgatgc gaatcttgcc aaagtctttg gctctagtga tcctatcgac 240
atgttccaaa tgaccaaaagc cctttccaaa catattgtaa aataa                                     285

```

&lt;210&gt; 79

<211> 950  
 <212> DNA  
 <213> Chlamydia

<400> 79  
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 tatccaagag acttacgatt tagctaagtc gtattccttg ggtgaagcga tagatatatt 240  
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 agcgttgtgt gcagccttag tttaaagctaa gcccgcaact gctaaaggac aatatttagt 780  
 taatttcact atttcctcga ccatggggcc aggggttacc gtggatacta gggagttgat 840  
 tgcgttataa ttctaagttt aaagaggaaa aatgaaagaa gagaaaaagt tgctgcttcg 900  
 cgaggttgaa gaaaagataa ccgcttctca aggttttatt ttgttgagat 950

<210> 80  
 <211> 395  
 <212> DNA  
 <213> Chlamydia

<400> 80  
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 ggctgggttta gcatctaagg caacagaagc tcctctgctg taataagtga attcttcaga 120  
 agtaggtgtt cctacttgcg atagcatcgt tcctagtcct gatatccaca ggttggtata 180  
 gctaaactta tcaaagcgag ctagattcat tttatcgttg agcaagcctt gtttgactgt 240  
 gaccattgac atttgagatc ccagaatcga gttcgcatag aaatgattgt ctctaggtag 300  
 ataagcccat tgtctataag agtcaaattt ccagagcgct gagatcgctt cattttgtag 360  
 ttgatcagga tccagagtga gtgttcctgt atatc 395

<210> 81  
 <211> 2085  
 <212> DNA  
 <213> Chlamydia

<400> 81  
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 agtctcagtt agaacaattt gctcaagtag gtttagatac aagttggcaa gttgttttcg 180  
 atccaggaat aggatttggg aagactcccg ttcagtcgat gttattgatg gatggagtaa 240  
 agcagtttaa acgtgtttta gagtgtcctg tattaatagg ccattctaga aaatcgtgtt 300  
 tgagtatgtt gggccgattt aatagtgcg atcgtgattg ggaaacgacg ggctgttctg 360  
 tatctcttca tgatcgagga gttgattatc tacgtgtgca tcaggttgaa ggtaacagac 420  
 gtgccttagc cgctgctgct tgggctggta tgtttgatg atccaagcaa caggatcgt 480  
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 ttgggagttc cttccagaca agtataagca tgggcgggat atcgttgtct tttctcgcag 660  
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 gaatcatcgg tttttaattg ggggagcggg gctctttgaa agttttttcc aacaaaaact 780  
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 ttattattat gaaaataact ccgatcaaaa cacgtaaagt atttgcacat gattcgtctc 960

```

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aaaagcgaaa gtagctactt tcatgcgggtg gtgtacagga gattcttttag ctgcaggagt 2040
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```

<210> 82  
 <211> 405  
 <212> DNA  
 <213> Chlamydia

```

<400> 82
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gcaatcatta tgcaacgagt ggtttgaaaa gcgggtacaa tattgggagt accgatgggt 120
ttctccctgt cattgggcct gttatatggg agtcggaggg tcttttccgc gcttatattt 180
cttcgggtgac tgatggggat ggtaagagcc ataaagtagg atttctaaga attcctacat 240
atagtttgca ggacatggaa gattttgatc cttcaggacc gcctccttgg gaagaattgt 300
attggctcca taaagggagg agaaaacttc gatataggga atcgtatcaa ggtgaaagta 360
gcaaaaaata aattagctcc tccattccga actgcagaat ttgat 405

```

<210> 83  
 <211> 379  
 <212> DNA  
 <213> Chlamydia

```

<400> 83
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ttccctacgt atcactttgc taatgtagtt gatgatcatt tgatggggat taccatgtg 180
ttgcgagggg aagagtgggt aagttctaca cctaaacacc ttcttcttta caaagctttt 240
gggtgggagc ctccgcagtt ttcccatatg ccgcttcttc taaatcctga tggaagtaag 300
ctttccaaga gaaagaatcc tacttctatt ttttactatc gggatgctgg atacaaaaaa 360
gaagcgttca tgaatttcc 379

```

<210> 84  
 <211> 715  
 <212> DNA  
 <213> Chlamydia

```

<400> 84
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cgccttccat tcttgatgca ataatatctg ctgagactaa gaacatgctc ccagagcttt 180
tggtgtgtgac tgtgaatttt cctatttcag ttctccttaa taaagtttca atgttctctg 240

```



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gagtgaataa cccgttgcac tgaatTTTTat tagtgattgg aaagttgtta aaagctttca 300
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caatagtatc agcaattcca ccaagaattt gatctcccaa cttttctaga ataagctggc 420
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caaggattat ttgctggctc ttgagcggct ctgtcatttg cccaactttg atattatcag 600
caaagacgca gttttgagtg ttatacaaat aaaaaccaga atttccatt ttaaaactct 660
tttttatTTT gagctTTTaaa taaattaggt ttttagtttc aagtttgcta ttaatt 715

```

&lt;210&gt; 85

&lt;211&gt; 476

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 85

```

ctcgtgccgc tegtgccgct cgtgccggct ttttagaaga gcgtgaagct ttaaataatt 60
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agaatgctgg tgtgctcacc tttaaagaca acattgtgaa gacttttgct tcgaat 476

```

&lt;210&gt; 86

&lt;211&gt; 1551

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 86

```

gcgtatcgat atttcttctg ttacattctt tatagggatt ctgttggtctg ttaatgcgct 60
aacctactct catgtattac gggattttatc tgtgagtatg gatgcgctgt tttctcgtaa 120
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ctacatatag ttggcaggac atggaagatt ttgatccttc aggaccgcct c 1551

```

&lt;210&gt; 87

&lt;211&gt; 3031

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 87

```
atgtaggccc tcaagcgggt ttattgttag accaaattcg agatctattc gttgggtcta 60
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aaaggagaac ttcagattt acatgctcta g 3031
```

&lt;210&gt; 88

```
<210> 89
<211> 94
<212> PRT
<213> Chlamydia
```

```
<210> 90
<211> 474
<212> PRT
<213> Chlamydia
```

```

<400> 90
Met Ala Ser His His His His His His Met Asn Glu Ala Phe Asp Cys
                    5              10              15
Val Val Ile Gly Ala Gly Pro Gly Gly Tyr Val Ala Ala Ile Thr Ala

```

20					25					30					
Ala	Gln	Ala	Gly	Leu	Lys	Thr	Ala	Leu	Ile	Glu	Lys	Arg	Glu	Ala	Gly
		35					40					45			
Gly	Thr	Cys	Leu	Asn	Arg	Gly	Cys	Ile	Pro	Ser	Lys	Ala	Leu	Leu	Ala
	50					55					60				
Gly	Ala	Glu	Val	Val	Thr	Gln	Ile	Arg	His	Ala	Asp	Gln	Phe	Gly	Ile
	65					70					75				80
His	Val	Glu	Gly	Phe	Ser	Ile	Asn	Tyr	Pro	Ala	Met	Val	Gln	Arg	Lys
				85					90					95	
Asp	Ser	Val	Val	Arg	Ser	Ile	Arg	Asp	Gly	Leu	Asn	Gly	Leu	Ile	Arg
			100					105					110		
Ser	Asn	Lys	Ile	Thr	Val	Phe	Ser	Gly	Arg	Gly	Ser	Leu	Ile	Ser	Ser
		115					120					125			
Thr	Glu	Val	Lys	Ile	Leu	Gly	Glu	Asn	Pro	Ser	Val	Ile	Lys	Ala	His
	130					135						140			
Ser	Ile	Ile	Leu	Ala	Thr	Gly	Ser	Glu	Pro	Arg	Ala	Phe	Pro	Gly	Ile
	145					150					155				160
Pro	Phe	Ser	Ala	Glu	Ser	Pro	Arg	Ile	Leu	Cys	Ser	Thr	Gly	Val	Leu
				165					170					175	
Asn	Leu	Lys	Glu	Ile	Pro	Gln	Lys	Met	Ala	Ile	Ile	Gly	Gly	Gly	Val
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Ile	Gly	Cys	Glu	Phe	Ala	Ser	Leu	Phe	His	Thr	Leu	Gly	Ser	Glu	Val
		195					200					205			
Ser	Val	Ile	Glu	Ala	Ser	Ser	Gln	Ile	Leu	Ala	Leu	Asn	Asn	Pro	Asp
		210					215					220			
Ile	Ser	Lys	Thr	Met	Phe	Asp	Lys	Phe	Thr	Arg	Gln	Gly	Leu	Arg	Phe
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Val	Leu	Glu	Ala	Ser	Val	Ser	Asn	Ile	Glu	Asp	Ile	Gly	Asp	Arg	Val
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Arg	Leu	Thr	Ile	Asn	Gly	Asn	Val	Glu	Glu	Tyr	Asp	Tyr	Val	Leu	Val
			260					265					270		
Ser	Ile	Gly	Arg	Arg	Leu	Asn	Thr	Glu	Asn	Ile	Gly	Leu	Asp	Lys	Ala
		275					280					285			
Gly	Val	Ile	Cys	Asp	Glu	Arg	Gly	Val	Ile	Pro	Thr	Asp	Ala	Thr	Met
	290						295					300			
Arg	Thr	Asn	Val	Pro	Asn	Ile	Tyr	Ala	Ile	Gly	Asp	Ile	Thr	Gly	Lys
	305					310					315				320
Trp	Gln	Leu	Ala	His	Val	Ala	Ser	His	Gln	Gly	Ile	Ile	Ala	Ala	Arg
				325					330					335	

Asn Ile Gly Gly His Lys Glu Glu Ile Asp Tyr Ser Ala Val Pro Ser  
                   340                                  345                                  350  
 Val Ile Phe Thr Phe Pro Glu Val Ala Ser Val Gly Leu Ser Pro Thr  
                   355                                  360                                  365  
 Ala Ala Gln Gln Gln Lys Ile Pro Val Lys Val Thr Lys Phe Pro Phe  
                   370                                  375                                  380  
 Arg Ala Ile Gly Lys Ala Val Ala Met Gly Glu Ala Asp Gly Phe Ala  
 385                                  390                                  395                                  400  
 Ala Ile Ile Ser His Glu Thr Thr Gln Gln Ile Leu Gly Ala Tyr Val  
                                   405                                  410                                  415  
 Ile Gly Pro His Ala Ser Ser Leu Ile Ser Glu Ile Thr Leu Ala Val  
                   420                                  425                                  430  
 Arg Asn Glu Leu Thr Leu Pro Cys Ile Tyr Glu Thr Ile His Ala His  
                   435                                  440                                  445  
 Pro Thr Leu Ala Glu Val Trp Ala Glu Ser Ala Leu Leu Ala Val Asp  
                   450                                  455                                  460  
 Thr Pro Leu His Met Pro Pro Ala Lys Lys  
 465                                  470

<210> 91  
 <211> 129  
 <212> PRT  
 <213> Chlamydia

<400> 91  
 Met His His His His His His Met Pro Arg Ile Ile Gly Ile Asp Ile  
                                   5                                  10                                  15  
 Pro Ala Lys Lys Lys Leu Lys Ile Ser Leu Thr Tyr Ile Tyr Gly Ile  
                   20                                  25                                  30  
 Gly Ser Ala Arg Ser Asp Glu Ile Ile Lys Lys Leu Lys Leu Asp Pro  
                   35                                  40                                  45  
 Glu Ala Arg Ala Ser Glu Leu Thr Glu Glu Glu Val Gly Arg Leu Asn  
                   50                                  55                                  60  
 Ser Leu Leu Gln Ser Glu Tyr Thr Val Glu Gly Asp Leu Arg Arg Arg  
                   65                                  70                                  75                                  80  
 Val Gln Ser Asp Ile Lys Arg Leu Ile Ala Ile His Ser Tyr Arg Gly  
                   85                                  90                                  95  
 Gln Arg His Arg Leu Ser Leu Pro Val Arg Gly Gln Arg Thr Lys Thr  
                   100                                  105                                  110  
 Asn Ser Arg Thr Arg Lys Gly Lys Arg Lys Thr Val Ala Gly Lys Lys  
                   115                                  120                                  125

Lys

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<210> 92
<211> 202
<212> PRT
<213> Chlamydia
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<400>	92															
Met	His	His	His	His	His	His	Met	Gly	Ser	Leu	Val	Gly	Arg	Gln	Ala	
				5					10					15		
Pro	Asp	Phe	Ser	Gly	Lys	Ala	Val	Val	Cys	Gly	Glu	Glu	Lys	Glu	Ile	
			20					25					30			
Ser	Leu	Ala	Asp	Phe	Arg	Gly	Lys	Tyr	Val	Val	Leu	Phe	Phe	Tyr	Pro	
		35					40					45				
Lys	Asp	Phe	Thr	Tyr	Val	Cys	Pro	Thr	Glu	Leu	His	Ala	Phe	Gln	Asp	
	50					55					60					
Arg	Leu	Val	Asp	Phe	Glu	Glu	His	Gly	Ala	Val	Val	Leu	Gly	Cys	Ser	
65					70					75					80	
Val	Asp	Asp	Ile	Glu	Thr	His	Ser	Arg	Trp	Leu	Thr	Val	Ala	Arg	Asp	
				85					90					95		
Ala	Gly	Gly	Ile	Glu	Gly	Thr	Glu	Tyr	Pro	Leu	Leu	Ala	Asp	Pro	Ser	
			100					105					110			
Phe	Lys	Ile	Ser	Glu	Ala	Phe	Gly	Val	Leu	Asn	Pro	Glu	Gly	Ser	Leu	
		115					120					125				
Ala	Leu	Arg	Ala	Thr	Phe	Leu	Ile	Asp	Lys	His	Gly	Val	Ile	Arg	His	
	130					135					140					
Ala	Val	Ile	Asn	Asp	Leu	Pro	Leu	Gly	Arg	Ser	Ile	Asp	Glu	Glu	Leu	
145					150					155					160	
Arg	Ile	Leu	Asp	Ser	Leu	Ile	Phe	Phe	Glu	Asn	His	Gly	Met	Val	Cys	
				165					170					175		
Pro	Ala	Asn	Trp	Arg	Ser	Gly	Glu	Arg	Gly	Met	Val	Pro	Ser	Glu	Glu	
			180					185					190			
Gly	Leu	Lys	Glu	Tyr	Phe	Gln	Thr	Met	Asp							
		195					200									

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<210> 93
<211> 19
<212> PRT
<213> Artificial Sequence
<220>
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<223> made in a lab

<400> 93

Glu	Asn	Ser	Leu	Gln	Asp	Pro	Thr	Asn	Lys	Arg	Asn	Ile	Asn	Pro	Asp
1				5					10					15	
Asp	Lys	Leu													

<210> 94

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 94

Asp	Pro	Thr	Asn	Lys	Arg	Asn	Ile	Asn	Pro	Asp	Asp	Lys	Leu	Ala	Lys
1				5					10					15	
Val	Phe	Gly	Thr												
				20											

<210> 95

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 95

Lys	Arg	Asn	Ile	Asn	Pro	Asp	Asp	Lys	Leu	Ala	Lys	Val	Phe	Gly	Thr
1				5					10					15	
Glu	Lys	Pro	Ile												
				20											

<210> 96

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 96

Asp	Asp	Lys	Leu	Ala	Lys	Val	Phe	Gly	Thr	Glu	Lys	Pro	Ile	Asp	Met
1				5					10					15	
Phe	Gln	Met	Thr												
				20											

<210> 97

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

&lt;400&gt; 97

Lys Val Phe Gly Thr Glu Lys Pro Ile Asp Met Phe Gln Met Thr Lys  
1 5 10 15  
Met Val Ser Gln  
20

&lt;210&gt; 98

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 98

Asn Lys Arg Asn Ile Asn Pro Asp Asp Lys Leu Ala Lys Val Phe Gly  
1 5 10 15  
Thr Glu Lys Pro  
20

&lt;210&gt; 99

&lt;211&gt; 16

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 99

Asn Lys Arg Asn Ile Leu Pro Asp Ala Asn Leu Ala Lys Val Phe Gly  
1 5 10 15

&lt;210&gt; 100

&lt;211&gt; 15

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 100

Lys Met Trp Asp Tyr Ile Lys Glu Asn Ser Leu Gln Asp Pro Thr  
1 5 10 15

&lt;210&gt; 101

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 101

Thr Glu Ile Val Lys Lys Val Trp Glu Tyr Ile Lys Lys His Asn Cys  
1 5 10 15  
Gln Asp Gln Lys  
20



<210> 102  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 102  
Lys Val Trp Glu Tyr Ile Lys Lys His Asn Cys Gln Asp Gln Lys Asn  
1 5 10 15  
Lys Arg Asn Ile  
20

<210> 103  
<211> 15  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 103  
Lys Val Trp Glu Tyr Ile Lys Lys His Asn Cys Gln Asp Gln Lys  
1 5 10 15

<210> 104  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 104  
Ala Glu Leu Thr Glu Glu Glu Val Gly Arg Leu Asn Ala Leu Leu Gln  
1 5 10 15  
Ser Asp Tyr Val  
20

<210> 105  
<211> 21  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 105  
Leu Gln Ser Asp Tyr Val Val Glu Gly Asp Leu Arg Arg Arg Val Gln  
1 5 10 15  
Ser Asp Ile Lys Arg  
20

<210> 106  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 106

Met Pro Arg Ile Ile Gly Ile Asp Ile Pro Ala Lys Lys Lys Leu Lys  
1 5 10 15  
Ile Ser Leu Thr  
20

<210> 107

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 107

Ala Glu Leu Thr Glu Glu Glu Val Gly Arg Leu Asn Ala Leu Leu Gln  
1 5 10 15  
Ser Asp Tyr Val  
20

<210> 108

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 108

Leu Asn Ala Leu Leu Gln Ser Asp Tyr Val Val Glu Gly Asp Leu Arg  
1 5 10 15  
Arg Arg Val Gln  
20

<210> 109

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 109

Leu Asn Ser Leu Leu Gln Ser Glu Tyr Thr Val Glu Gly Asp Leu Arg  
1 5 10 15  
Arg Arg Val Gln  
20

<210> 110

<211> 1461

<212> DNA

<213> Chlamydia

<400> 110

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ctatctatga agttatgaat atggatctag aaacacgaag atcttttgcg gtacagcaag 60
ggcactatca ggacccaaga gcttcagatt atgacctccc acgtgctagc gactatgatt 120
tgcctagaag cccatattcct actccacctt tgccttctag atatcagcta cagaatatgg 180
atgtagaagc aggggttcgt gaggcagttt atgcttcttt tgtagcagga atgtacaatt 240
atgtagtgac acagccgcaa gagcgtatcc ccaatagtca gcagggtggaa gggattctgc 300
gtgatatgct taccaacggg tcacagacat ttagcaacct gatgcagcgt tgggatatag 360
aagtcgatag ggaataaact ggtatctacc ataggtttgt atcaaaaaac taagcccacc 420
aagaagaaat tctcttttgt gggcttcttt ttttattcaa aaaagaaagc cctcttcaag 480
attatctcgt gccgctcgtg ccgaattcgg cagcagcggc acgaggagct gtaagtaagt 540
attgccaaga gttggaagaa aaaatattag atttgtgtaa gcgtcatgcc gcaacaattt 600
gctccattga ggaggatgct aaacaagaaa ttcgatcatca gacagaaagg tttaacagc 660
ggttgcaaca aaatcagaac acttgcatgc aattaacagc agagttgtgt aaattgagat 720
ctgagaataa ggcattatcg gagcggctgc aggtgcaggc atcccgctcg aaaaaataat 780
taaagactcc tcagatattg catctgagag ttaggggttc cttttgctta cggcgcttta 840
gttctgcatg ttgctgattt atagtattt gcgagtaaag cgccgttctg atacagtttt 900
tccgctttaa aaataaaaag gtggaaaaat gactactact attagcggag acgcttcttc 960
tttaccgttg ccaacagcct cctgcgtaga gacaaaatct acttcgtctt caacaaaagg 1020
gaatacttgt tccaaaattt tggatatagc tttagctatc gtaggcgctt tagttgttgt 1080
cgctggggta ttagcttttg ttttgtgcgc tagcaatgtc atatttactg taataggat 1140
tcttgcatga attattggat ctgcttgtgt ggggtgcggga atatctcgtc ttatgtatcg 1200
atcctcttat gctagcttag aagcaaaaaa tgttttggtc gagcaacgct tgcgtaatct 1260
ttcagaagag aaggacgctt tggcctcgtc ctctttcatt aataagatgt ttctgcgagg 1320
tcttacggac gatctccaag ctttggaagc taaggtaatg gaatttgaga ttgattgttt 1380
ggacagatta gagaaaaatg agcaagcttt attgtccgat gtgcgcttag ttttatctag 1440
ctacacaaga tggttggata g
1461

```

&lt;210&gt; 111

&lt;211&gt; 267

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 111

```

gtcctcttct tattatagca gaagacattg aaggcgaagc tttagctact ttggtcgtga 60
acagaattcg tggaggattc cgggttttgcg cagttaaagc tccaggcttt ggagatagaa 120
gaaaagctat gttggaagac atcgctatct taactggcgg tcaactcatt agcgaagagt 180
tgggcatgaa attagaaaac gctaacttag ctatgttagg taaagctaaa aaagttatcg 240
tttctaaaga agacacgacc atcgctcg
267

```

&lt;210&gt; 112

&lt;211&gt; 698

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 112

```

tgataagcaa gcaaccgctc aactagcagc tctaactatt aaaaaaatcc tctgttttga 60
tgaaaattcc tacgagaagg agctggcatg cttagaaaag aaacgcagta gcgtacaaaa 120
agatctgagc caactgaaaa aatacacagt tctctacatc aagaagctgc tcgaaacctt 180
cagacaactc gggcatcgaa agacaaaaat tgcaaaattt gatgacctac ctaccgagag 240
agtctccgct cataagaaag caaaagaact cgctgcgctc gatcaagaag agaacttcta 300
aaacgtgact cggcccttga gatccttaaa ctctcgggcc aaaaagacta cagtcttctc 360
gagaagaaaa acggtgttag aaaatacgcg cgctaagact ttctctaaca atgactcaaa 420
aagctgtaaa cgtatacgtt taccgctctt ccataatttc taggetgact ttcacattat 480
ctcgacttgc tacggaaacc aataaagtac ggatagcctt aatagtgcgt ccttctttac 540
cgataatttt accgatattc cccttagcaa cagtcaattc gtagataatc gtattgggtc 600
cctgcacctc tttcagatgc acttctctcg gcttatcaac aagatttttt acaatgtacg 660
ctaaaaactc tttcatgcga agcaaatcct acacaagc
698

```

&lt;210&gt; 113

&lt;211&gt; 1142

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 113

```

ctcttcaaaag attgtgagtt tatgtgaagg cgctgtcgct gatgcaagaa tgtgcaaagc 60
agagttgata aaaaaagaag cggatgctta tttgttttgt gagaaaagcg ggatatatct 120
aacgaaaaaa gaaggtatct tgattccttc tgcagggatt gatgaatcga atacggacca 180
gccttttggt ttatatccca aagatatttt gggatcggtg aatcgcatcg gagaatgggt 240
aagaaattat tttcgagtga aagagctagg cgtaatcatt acagatagcc atactactcc 300
aatgcggcgt ggagtactgg gtatcgggct gtgttggtat ggattttctc cattacacaa 360
ctatatagga tcgctagatt gtctcggtcg tcccttacag atgacgcaaa gtaatcttgt 420
agatgcctta gcagttgcgg ctgttggttg tatgggagag gggaatgagc aaacaccgtt 480
agcggtgata gagcaggcac ctaatatggt ctaccattca tatcctactt ctcgagaaga 540
gtattgttct ttgcgcatag atgaaacaga ggacttatac ggaccttttt tgcaagcggg 600
tacgtggagt caagaaaaga aatgatggag gtgtttatga atttttttaga tcagttagat 660
ttaattattc aaaataagca tatgctagaa cacacgtttt atgtgaaatg gtcgaagggg 720
gagcttacta aagagcaatt acaggcgtat gccaaagact attattttaca tatcaaagcc 780
tttctaaat atttatctgc gattcatagt cgttgcatg attttagagc gcgtaagtta 840
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cagtttgtgt ttgctctagg agttactcca gaagagttag aggctcatga gcctagtga 960
gcagcaaaag cgaaagtagc tactttcatg cgggtggtga caggagattc tttagctgca 1020
ggagtggctg ctttgtattc ttatgagagt caaattccac gtatcgctag agagaaaatt 1080
cgtggattga ctgagtactt tggattttcc aatcctgaag actatgcata tttcacagaa 1140
ca
1142

```

&lt;210&gt; 114

&lt;211&gt; 976

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 114

```

aggtggatgg ggcgcctgtc caagatgtgc tcgctactct atatggaagc aatcacaaag 60
ggactgcagc tgaagagtcg gctgctttta gaacactatt ttctcgcatg gcctctttag 120
ggcacaaggt acctctctgg cgcactactt taaagattcg tcgtcctttt ggtactacga 180
gagaagtctg tgtgaaatgg cgttatgttc ctgaaggtgt aggagatttg gctaccatag 240
ctccttctat cagggtccca cagttacaga aatcgatgag aagctttttc cctaagaaag 300
atgatgcgtt tcatcggtct agttcgctat tctactctcc aatgggtccg catttttggg 360
cagagcttgc caatcattat gcaacgagtg gtttgaagag cgggtacaat attgggagta 420
ccgatgggtt tctcctgtc attgggcctg ttatatggga gtcggagggt cttttccgcg 480
cttatatttc ttcggtgact gatggggatg gtaagagcca taaagtagga tttctaagaa 540
ttctacata tagttggcag gacatggaag attttgatcc ttcaggaccg cctccttggg 600
aagaatttgc taagattatt caagtatttt cttctaatac agaagctttg attatcgacc 660
aaacgaacaa cccagggtgg agtgcctttt atctttatgc actgctttcc atgttgacag 720
accgtccttt agaacttcct aaacatagaa tgattctgac tcaggatgaa gtggttgatg 780
ctttagattg gtttaacctg ttggaaaacg tagacacaaa cgtggagtct cgctttgctc 840
tgggagacaa catggaagga tatactgtgg atctacaggt tgccgagtat ttaaaagct 900
ttggacgtca agtattgaat tgttgagta aaggggatat cgagttatca acacctattc 960
ctcttttttg ttttga
976

```

&lt;210&gt; 115

&lt;211&gt; 995

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 115

```

ttatcctaga aatttggtgt tcaatatgag cgaaaaaaga aagtctaaca aaattattgg 60
tatcgacctg gggacgacca actcttgcgt ctctgttatg gaaggtggcc aacctaaagt 120

```

```

tattgcctct tctgaaggaa ctcgtactac tcttctctatc gttgctttta aaggtggcga 180
aactcttggt ggaattcctg caaaacgtca ggcagtaacc aatcctgaaa aaacattggc 240
ttctactaag cgattcatcg gtagaaaatt ctctgaagtc gaatctgaaa ttaaaacagt 300
ccccacaaa gttgctccta actcgaaagg agatgcggtc tttgatgtgg aacaaaaact 360
gtacactcca gaagaaatcg gcgctcagat cctcatgaag atgaaggaaa ctgctgaggc 420
ttatctcgga gaaacagtaa cggaagcagt cattaccgta ccagcttact ttaacgattc 480
tcaaagagct tctacaaaag atgctggacg tatcgagga ttagatgtta aacgcattat 540
tcctgaacca acagcgcccg ctcttgctta tggattgat aaggaaggag ataaaaaat 600
cgccgtcttc gacttaggag gaggaacttt cgatatttct atcttggaaa tcggtgacgg 660
agtttttgaa gttctctcaa ccaacgggga tactcacttg ggaggagacg acttcgacgg 720
agtcatcatc aactggatgc ttgatgaatt caaaaaacaa gaaggcattg atctaagcaa 780
agataacatg gctttgcaaa gattgaaaga tgctgctgaa aaagcaaaaa tagaattgtc 840
tgggtgatcg tctactgaaa tcaatcagcc attcatcact atcgacgcta atggacctaa 900
acatttggct ttaactctaa ctcgcgctca attcgaacac ctagcttctc ctctcattga 960
gcgaaccaa caaccttggt ctcaggcttt aaaag 995

```

&lt;210&gt; 116

&lt;211&gt; 437

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 116

```

gtcacagcta aaggcggtgg gctttatact gataagaatc tttcgattac taacatcaca 60
ggaattatcg aaattgcaaa taacaaagcg acagatgttg gaggtgggtg ttacgtaaaa 120
ggaaccctta cttgtaaaaa ctctcaccgt ctacaatttt tgaaaaactc ttccgataaa 180
caagggtggag gaatctacgg agaagacaac atcacctat ctaatttgac agggaagact 240
ctattccaag agaatactgc caaaaaagag ggcggtggac tcttcataaa aggtacagat 300
aaagctctta caatgacagg actggatagt ttctgtttaa ttaataacac atcagaaaaa 360
catggtgggt gagcctttgt taccaaagaa atctctcaga cttacacctc tgatgtggaa 420
acaattccag gaatcac 437

```

&lt;210&gt; 117

&lt;211&gt; 446

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 117

```

aagtttacct agaccaaact gaagatgacg aaggaaaagt tgttttatcc agagaaaaag 60
caacaagaca acgacaatgg gaatacattc ttgctcactg cgaggaaggt tctattgtta 120
agggacaaat taccgaaaa gttaagggtg gtttgatcgt agatattggg atggaagcct 180
tccttccagg atcccaaata gacaataaga agatcaagaa cttagatgat tacgtaggca 240
aggtttgtga gttcaaaatt ctcaaaatca acgtggatcg tcggaacgtt gttgtatcta 300
gaagagaact tctcgaagct gaacgcattt ctaagaaagc agagttgatc gagcaaatca 360
ctatcggtga acgtcgcaaa ggtatcggtta agaatatcac agatttcgga gtattcttgg 420
atcttgatgg cattgacggc ctactc 446

```

&lt;210&gt; 118

&lt;211&gt; 951

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 118

```

agtattgcga aatattactg tgagaagcaa tgctgagagc ggttctagta aaagtgaggg 60
gagagctgtc agaagggatc gctcaggaag cgagacaacg tgtggctgat ttattaggaa 120
gattccctct ttatcctgaa atcgatctgg aaacgctagt ttagtgggag actctatgcc 180
tgaaggggaa atgatgcata agttgcaaga tgcatagat agaaagtgtg tggattctcg 240
tcgtattttc ttctccgaac ctgtaacgga gaaaagtgtc gcagaagcca tcaaaaagct 300
ttgggtatttg gaactcacca atcctgggca gccaatgtta tttgtcatta atagccctgg 360

```

```

aggggtctgtt gatgctgggt ttgctgtttg ggaccaaatt aaaatgatct cttctccttt 420
gactacagtt gttacaggtt tagcagcatc tatgggatct gtattgagtt tgtgtgctgt 480
tccaggaaga cgttttgcta cgctcatgc gcgcattatg attcaccagc cttctattgg 540
aggaaccatt actggccaag ccacggactt ggatattcat gctcgtgaaa ttttaaaac 600
aaaagcacgc attattgatg tgtatgtcga ggcaactgga caatctccag aggtgataga 660
gaaagctatc gatcgagata tgtggatgag tgcaaataaa gcaatggagt ttggactgtt 720
agatgggatt ctcttctctt ttaacgactt gtagatatct tttatattct ggagcaggaa 780
acagtttcat tttgggagaa tcgatgcctt ctcttgagga tgttctgttt ttatgccagg 840
aagagatggt tgatgggttt ttatgtgtag agtcttctga aatagcagat gctaaactca 900
ctgttttttaa tagtgatgga tctatcgcgt ctatgtgcgg gaatgggttg c 951

```

&lt;210&gt; 119

&lt;211&gt; 953

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 119

```

atatcaaagt tgggcaaatt acagagccgc tcaaggacca gcaaataatc cttgggacaa 60
catcaacacc tgtcgcagcc aaaatgacag cttctgatgg aatatcttta acagtctcca 120
ataatccatc aaccaatgct tctattacaa ttggtttggg tgcggaaaaa gcttaccagc 180
ttattctaga aaagtttgga gatcaaatc ttgggtggaat tgcgtgatact attgttgata 240
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ttctagcttt ggtacgagaa ggtgattcta agccctacgc gattagttat ggatactcat 540
caggcggttc taatttatgt agtctaagaa ccagaattat taatacagga ttgactccga 600
caacgtattc attacgtgta ggcggttttag aaagcggtgt ggtatgggtt aatgcccttt 660
ctaattggca tgatatttta ggaataacaa atactctaa tgtatctttt ttggaggtaa 720
tacctcaaac aaacgcttaa acaattttta ttggattttt cttataggtt ttatatttag 780
agaaaaaagt tcgaattacg gggtttgtta tgcaaaaata aagcaaagtg agggacgatt 840
ttattaaaat tgttaaagat tcctgggtatc ggtctgcgat tccgactcgt ccaacatcaa 900
tacaacctat taatttcccc tcgtcaaaaa taaggttatc aagtgagaaa tca 953

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&lt;210&gt; 120

&lt;211&gt; 897

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; misc\_feature

&lt;222&gt; (1) ... (897)

&lt;223&gt; n = A,T,C or G

&lt;400&gt; 120

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acacagccca gcaataaaat ggcaagggtg gtaataaaga cgaagggaat ggataagact 120
gttaaggctg ccaagtctgc tgccgaattg accgcaaata ttttggaaca agctggaggc 180
gcgggctctt ccgcacacat tacagcttcc caagtgtcca aaggattagg ggatgcgaga 240
actgttctcg ctttagggaa tgcctttaac ggagcgttgc caggaaacag tcaaagtgcg 300
caaaagcttct tctcttacat gaaagctgct agtcagaaac cgcaagaagg ggatgagggg 360
ctcgtagcag atctttgtgt gtctcataag cgcanaagcg ctgcggctgt ctgtagcttc 420
atcggaggaa ttacctacct cgcgacattc ggagctatcc gtccgattct gtttgtcaac 480
aaaatgctgg cgcaaccgtt tctttcttcc caaattaaag caaatatggg atcttctgtt 540
agctatatta tggcggttaa ccattgcagc tttgtgggtg gttctggact cgctatcagt 600
gcggaaagag gacattgcga agcccgtgc gctcgtattg cgagagaaga gtcgtcactc 660
gaattgtcgg gagaggaaaa tgcttgcgag aggagagtcg ctggagagaa agccaagacg 720

```

```

ttcacgcgca tcaagtatgc actcctcact atgctcgaga agtttttggga atgcgttgcc 780
gacgttttca aattgggtgcc gttgcctatt acaatgggta ttcgtgcaat tgtggctgcg 840
ggatgtacgt tcacttctgc agttattgga ttgtggactt tctgcgccag agcataa 897

```

&lt;210&gt; 121

&lt;211&gt; 298

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 121

```

Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu
 1          5          10          15
Lys Ala Phe Phe Thr Gln Pro Ser Asn Lys Met Ala Arg Val Val Asn
          20          25          30
Lys Thr Lys Gly Met Asp Lys Thr Val Lys Val Ala Lys Ser Ala Ala
          35          40          45
Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser
 50          55          60
Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Ala Arg
 65          70          75          80
Thr Val Leu Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr
          85          90          95
Val Gln Ser Ala Gln Ser Phe Phe Ser Tyr Met Lys Ala Ala Ser Gln
          100          105          110
Lys Pro Gln Glu Gly Asp Glu Gly Leu Val Ala Asp Leu Cys Val Ser
          115          120          125
His Lys Arg Arg Ala Ala Ala Val Cys Ser Phe Ile Gly Gly Ile
 130          135          140
Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile Leu Phe Val Asn
 145          150          155          160
Lys Met Leu Ala Gln Pro Phe Leu Ser Ser Gln Ile Lys Ala Asn Met
          165          170          175
Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Phe Val
          180          185          190
Val Gly Ser Gly Leu Ala Ile Ser Ala Glu Arg Ala Asp Cys Glu Ala
          195          200          205
Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Ser Leu Glu Leu Ser Gly
 210          215          220
Glu Glu Asn Ala Cys Glu Arg Arg Val Ala Gly Glu Lys Ala Lys Thr
 225          230          235          240
Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu
          245          250          255
Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met
          260          265          270
Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Val
          275          280          285
Ile Gly Leu Trp Thr Phe Cys Ala Arg Ala
 290          295

```

&lt;210&gt; 122

&lt;211&gt; 897

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 122

```

atggccttcta tatgcggacg tttagggtct ggtacagggga atgctctaaa agcttttttt 60
acacagccca gcaataaaat ggcaagggta gtaaataaga cgaagggaat ggataagact 120
gttaagggtcg ccaagtctgc tgccgaattg accgcaaata ttttggaaca agctggaggc 180

```

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gcgggctctt ccgcacacat tacagcttcc caagtgtcca aaggattagg ggatacgaga 240
actgttgctg ctttagggaa tgcctttaac ggagcgttgc caggaacagt tcaaagtgcg 300
caaagcttct tctctcacat gaaagctgct agtcagaaaa cgcaagaagg ggatgagggg 360
ctcacagcag atctttgtgt gtctcataag cgcagagcgg ctgcggctgt ctgtggcttc 420
atcggaggaa ttacctacct cgcgacattc ggagttatcc gtccgattct gtttgtcaac 480
aaaatgctgg tgaacccggt tctttcttcc caaactaaag caaatatggg atcttctgtt 540
agctatatta tggcggctaa ccatgcagcg tctgtggtgg gtgctggact cgctatcagt 600
gcggaagag cagattgcga agcccgtgc gctcgtattg cgagagaaga gtcgttactc 660
gaagtgtcgg gagaggaaaa tgcttgcgag aagagagtcg ctggagagaa agccaagacg 720
ttcacgcgca tcaagtatgc actcctcact atgctcgaga agtttttgga atgcgttgcc 780
gacgttttca aattggtgcc gctgcctatt acaatgggta ttcgtgcgat tgtggctgct 840
ggatgtacgt tcacttctgc aattattgga ttgtgcactt tctgcgccag agcataa 897

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<210> 123

<211> 298

<212> PRT

<213> Chlamydia

<400> 123

```

Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu
 1           5           10           15
Lys Ala Phe Phe Thr Gln Pro Ser Asn Lys Met Ala Arg Val Val Asn
          20           25           30
Lys Thr Lys Gly Met Asp Lys Thr Val Lys Val Ala Lys Ser Ala Ala
          35           40           45
Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser
          50           55           60
Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Thr Arg
          65           70           75           80
Thr Val Val Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr
          85           90           95
Val Gln Ser Ala Gln Ser Phe Phe Ser His Met Lys Ala Ala Ser Gln
          100          105          110
Lys Thr Gln Glu Gly Asp Glu Gly Leu Thr Ala Asp Leu Cys Val Ser
          115          120          125
His Lys Arg Arg Ala Ala Ala Val Cys Gly Phe Ile Gly Gly Ile
          130          135          140
Thr Tyr Leu Ala Thr Phe Gly Val Ile Arg Pro Ile Leu Phe Val Asn
          145          150          155          160
Lys Met Leu Val Asn Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met
          165          170          175
Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val
          180          185          190
Val Gly Ala Gly Leu Ala Ile Ser Ala Glu Arg Ala Asp Cys Glu Ala
          195          200          205
Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Leu Leu Glu Val Ser Gly
          210          215          220
Glu Glu Asn Ala Cys Glu Lys Arg Val Ala Gly Glu Lys Ala Lys Thr
          225          230          235          240
Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu
          245          250          255
Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met
          260          265          270
Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Ile
          275          280          285
Ile Gly Leu Cys Thr Phe Cys Ala Arg Ala
          290          295

```



&lt;210&gt; 124

&lt;211&gt; 897

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 124

```

atggcttcta tatgcggacg tttaggggtct ggtacagggg atgctctaaa agcttttttt      60
acacagccca acaataaaaat ggcaagggta gtaaataaga cgaaggggaat ggataagact      120
attaaggttg ccaagtctgc tgccgaattg accgcaaata ttttggaaca agctggaggc      180
gcgggtcttt ccgcacacat tacagcttcc caagtgtcca aaggattagg ggatgcgaga      240
actgttgctg ctttagggaa tgctttaaac ggagcgttgc caggaacagt tcaaagtgcg      300
caaagcttct tctctcacat gaaagctgct agtcagaaaa cgcaagaagg ggatgagggg      360
ctcacagcag atctttgtgt gtctcataag cgcagagcgg ctgcggtgt ctgtagcatc      420
atcggaggaa ttacctacct cgcgacattc ggagctatcc gtccgattct gtttgtcaac      480
aaaaatgctg caaaaccgtt tctttcttcc caaactaaag caaatatggg atcttctgtt      540
agctatatta tggcggctaa ccatgcagcg tctgtggtgg gtgctggact cgctatcagt      600
gcggaagag cagattgcga agcccgtgc gctcgtattg cgagagaaga gtcgttactc      660
gaagtgccgg gagaggaaaa tgcttgcgag aagaaagtcg ctggagagaa agccaagacg      720
ttcacgcgca tcaagtatgc actcctcact atgctcgaga agtttttgga atgcgttgcc      780
gacgttttca aattggtgcc gctgcctatt acaatgggta ttcgtgcgat tgtggtgct      840
ggatgtacgt tcacttctgc aattattgga ttgtgcactt tctgcgccag agcataa      897

```

&lt;210&gt; 125

&lt;211&gt; 298

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 125

```

Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu
 1              5              10              15
Lys Ala Phe Phe Thr Gln Pro Asn Asn Lys Met Ala Arg Val Val Asn
              20              25              30
Lys Thr Lys Gly Met Asp Lys Thr Ile Lys Val Ala Lys Ser Ala Ala
              35              40              45
Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser
              50              55              60
Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Ala Arg
65              70              75              80
Thr Val Val Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr
              85              90              95
Val Gln Ser Ala Gln Ser Phe Phe Ser His Met Lys Ala Ala Ser Gln
              100             105             110
Lys Thr Gln Glu Gly Asp Glu Gly Leu Thr Ala Asp Leu Cys Val Ser
              115             120             125
His Lys Arg Arg Ala Ala Ala Val Cys Ser Ile Ile Gly Gly Ile
              130             135             140
Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile Leu Phe Val Asn
145             150             155             160
Lys Met Leu Ala Lys Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met
              165             170             175
Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val
              180             185             190
Val Gly Ala Gly Leu Ala Ile Ser Ala Glu Arg Ala Asp Cys Glu Ala
              195             200             205
Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Leu Leu Glu Val Pro Gly
              210             215             220
Glu Glu Asn Ala Cys Glu Lys Lys Val Ala Gly Glu Lys Ala Lys Thr
225             230             235             240

```

Phe	Thr	Arg	Ile	Lys	Tyr	Ala	Leu	Leu	Thr	Met	Leu	Glu	Lys	Phe	Leu
				245					250					255	
Glu	Cys	Val	Ala	Asp	Val	Phe	Lys	Leu	Val	Pro	Leu	Pro	Ile	Thr	Met
			260					265					270		
Gly	Ile	Arg	Ala	Ile	Val	Ala	Ala	Gly	Cys	Thr	Phe	Thr	Ser	Ala	Ile
			275				280					285			
Ile	Gly	Leu	Cys	Thr	Phe	Cys	Ala	Arg	Ala						
	290					295									

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<210> 126
<211> 897
<212> DNA
<213> Chlamydia
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<400> 126						
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acacagccca	acaataaaat	ggcaagggtg	gtaaataaga	cgaagggaat	ggataagact	120
attaaggttg	ccaagtctgc	tgccgaattg	accgcaaata	ttttggaaca	agctggaggc	180
gcgggctctt	ccgcacacat	tacagcttcc	caagtgtcca	aaggattagg	ggatgcgaga	240
actgtttgtg	cttttagggaa	tgcctttaac	ggagcgttgc	caggaacagt	tcaaagtgcg	300
caaagcttct	tctctcacat	gaaagctgct	agtcagaaaa	cgcaagaaggt	ggatgagggg	360
ctcacagcag	atctttgtgt	gtctcataag	cgcagagcgg	ctgcggctgt	ctgtagcatc	420
atcggaggaa	ttacctacct	cgcgacattc	ggagctatcc	gtccgattct	gtttgtcaac	480
aaaatgctgg	caaaaccgtt	tctttcttcc	caaactaaag	caaatatggg	atcttctggt	540
agctatatta	tggcgggctaa	ccatgcagcg	tctgtggtgg	gtgctggact	cgctatcagt	600
gcggaaagag	cagattgcga	agcccgcgtc	gctcgtattg	cgagagaaga	gtcgttactc	660
gaagtgccgg	gagaggaaaa	tgettgcgag	aagaaagtcc	ctggagagaa	agccaagacg	720
ttcacgcgca	tcaagtatgc	actcctcact	atgctcgaga	agtttttggg	atgcgttgcc	780
gcggttttca	aattggtgcc	gctgcctatt	acaatggcta	tctgtgcgat	tgtggctgct	840
ggatgtacgt	tcactttctgc	aattattgga	ttgtgcactt	tctgcgccag	agcataa	897

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<210> 127
<211> 298
<212> PRT
<213> Chlamydia
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	<400> 127															
Met 1	Ala	Ser	Ile	Cys 5	Gly	Arg	Leu	Gly	Ser 10	Gly	Thr	Gly	Asn 15	Ala	Leu	
Lys	Ala	Phe	Phe 20	Thr	Gln	Pro	Asn 25	Asn	Lys	Met	Ala	Arg	Val 30	Val	Asn	
Lys	Thr	Lys 35	Gly	Met	Asp	Lys 40	Thr	Ile	Lys	Val	Ala	Lys 45	Ser	Ala	Ala	
Glu	Leu	Thr	Ala	Asn	Ile	Leu 55	Glu	Gln	Ala	Gly	Gly 60	Ala	Gly	Ser	Ser	
Ala 65	His	Ile	Thr	Ala	Ser	Gln 70	Val	Ser	Lys	Gly 75	Leu	Gly	Asp	Ala 80	Arg	
Thr	Val	Val	Ala	Leu 85	Gly	Asn	Ala	Phe	Asn 90	Gly	Ala	Leu	Pro 95	Gly	Thr	
Val	Gln	Ser	Ala 100	Gln	Ser	Phe	Phe 105	Ser	His	Met	Lys	Ala	Ala 110	Ser	Gln	
Lys	Thr	Gln	Glu 115	Gly	Asp	Glu 120	Gly	Leu	Thr	Ala	Asp	Leu 125	Cys	Val	Ser	
His	Lys 130	Arg	Arg	Ala	Ala	Ala 135	Ala	Val	Cys	Ser	Ile 140	Ile	Gly	Gly	Ile	
Thr 145	Tyr	Leu	Ala	Thr	Phe	Gly 150	Ala	Ile	Arg	Pro	Ile 155	Leu	Phe	Val	Asn	
Lys	Met	Leu	Ala	Lys	Pro	Phe	Leu	Ser	Ser	Gln	Thr	Lys	Ala	Asn	Met	

165 170 175  
 Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val  
 180 185 190  
 Val Gly Ala Gly Leu Ala Ile Ser Ala Glu Arg Ala Asp Cys Glu Ala  
 195 200 205  
 Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Leu Leu Glu Val Pro Gly  
 210 215 220  
 Glu Glu Asn Ala Cys Glu Lys Lys Val Ala Gly Glu Lys Ala Lys Thr  
 225 230 235 240  
 Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu  
 245 250 255  
 Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met  
 260 265 270  
 Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Ile  
 275 280 285  
 Ile Gly Leu Cys Thr Phe Cys Ala Arg Ala  
 290 295

<210> 128  
 <211> 897  
 <212> DNA  
 <213> Chlamydia

<400> 128  
 atggcttcta tatgtggacg tttaggggtct ggtacagggga atgctctaaa agcttttttt 60  
 acacagccca gcaataaaat ggcaagggtta gtaataaaga cgaagggaat ggataagact 120  
 gttaagggtcg ccaagtctgc tgccgaattg accgcaaata ttttggaaca agctggaggc 180  
 gcgggctctt ccgcacacat tacagcttcc caagtgtcca aaggattagg ggatacgaga 240  
 actgttgtcg ctttagggaa tgcctttaac ggagcgttgc caggaacagt tcaaagtgcg 300  
 caaagcttct tctctcacat gaaagctgct agtcagaaaa cgcaagaagg ggatgagggg 360  
 ctcacagcag atcttttgtgt gtctcataag cgcagagcgg ctgctggctgt ctgtggcttc 420  
 atcggaggaa ttacctacct cgcgacattc ggagttatcc gtccgattct gtttgtcaac 480  
 aaaatgctgg tgaacccgtt tctttcttcc caaactaaag caaatatggg atcttctgtt 540  
 agctatatta tggcgggctaa ccatgcagcg tctgtggtgg gtgctggact cgetatcagt 600  
 gcggaaagag cagattgcga agcccgcgtgc gctcgtattg cgagagaaga gtcgttactc 660  
 gaagtgtcgg gagaggaana tgcttgcgag aagagagtcg ctggagagaa agccaagacg 720  
 ttcacgcgca tcaagtatgc actcctcact atgctcgaga agtttttggg atgcgttgcc 780  
 gacgttttca aattggtgcc gctgcctatt acaatgggta ttcgtgcgat tgtggctgct 840  
 ggatgtacgt tcacttctgc aattattgga ttgtgcactt tctgcgccag agcataa 897

<210> 129  
 <211> 298  
 <212> PRT  
 <213> Chlamydia

<400> 129  
 Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu  
 1 5 10 15  
 Lys Ala Phe Phe Thr Gln Pro Ser Asn Lys Met Ala Arg Val Val Asn  
 20 25 30  
 Lys Thr Lys Gly Met Asp Lys Thr Val Lys Val Ala Lys Ser Ala Ala  
 35 40 45  
 Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser  
 50 55 60  
 Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Thr Arg  
 65 70 75 80  
 Thr Val Val Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr  
 85 90 95

Val Gln Ser Ala Gln Ser Phe Phe Ser His Met Lys Ala Ala Ser Gln  
 100 105 110  
 Lys Thr Gln Glu Gly Asp Glu Gly Leu Thr Ala Asp Leu Cys Val Ser  
 115 120 125  
 His Lys Arg Arg Ala Ala Ala Val Cys Gly Phe Ile Gly Gly Ile  
 130 135 140  
 Thr Tyr Leu Ala Thr Phe Gly Val Ile Arg Pro Ile Leu Phe Val Asn  
 145 150 155 160  
 Lys Met Leu Val Asn Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met  
 165 170 175  
 Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val  
 180 185 190  
 Val Gly Ala Gly Leu Ala Ile Ser Ala Glu Arg Ala Asp Cys Glu Ala  
 195 200 205  
 Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Leu Leu Glu Val Ser Gly  
 210 215 220  
 Glu Glu Asn Ala Cys Glu Lys Arg Val Ala Gly Glu Lys Ala Lys Thr  
 225 230 235 240  
 Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu  
 245 250 255  
 Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met  
 260 265 270  
 Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Ile  
 275 280 285  
 Ile Gly Leu Cys Thr Phe Cys Ala Arg Ala  
 290 295

&lt;210&gt; 130

&lt;211&gt; 897

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 130

atggctgcta	tatgtggacg	tttagggctct	ggtacagggga	atgctctaaa	agctttttttt	60
acacagccca	gcaataaaat	ggcaagggta	gtaaataaga	cgaaggggaat	ggataagact	120
gttaaggtcg	ccaagtctgc	tgccgaattg	accgcaaata	ttttggaaca	agctggaggc	180
gcgggctctt	ccgcacacat	tacagcttcc	caagtgtcca	aaggattagg	ggatgcgaga	240
actgttctcg	ctttaggga	tgccctttaac	ggagcgttgc	caggaacagt	tcaaagtgcg	300
caaaagcttct	tctcttacat	gaaagctgct	agtcagaaac	cgcaagaagg	ggatgagggg	360
ctcgtagcag	atcttttgtt	gtctcataag	cgcagagcgg	ctgcggtgt	ctgtagcttc	420
atcgaggaa	ttacctacct	cgcgacattc	ggagctatcc	gtccgattct	gtttgtcaac	480
aaaatgctgg	cgcaaccgtt	tctttcttcc	caaaactaaag	caaatatggg	atcttctggt	540
agctatatatta	tggcggctaa	ccatgcagcg	tttgtggtgg	gttctggact	cgctatcagt	600
gcggaaagag	cagattgcga	agcccgtctc	gctcgtattg	cgagagaaga	gtcgtcactc	660
gaattgtcgg	gagaggaaaa	tgcttgcgag	aggggagtcg	ctggagagaa	agccaagacg	720
ttcacgcgca	tcaagtatgc	actcctcact	atgctcgaga	agtttttgga	atgcgttgcc	780
gacgttttca	aattgggtgc	gttgccctatt	acaatgggta	ttcgtgcaat	tgtggctgcg	840
ggatgtacgt	tcacttctgc	agttattgga	ttgtggactt	tctgcaacag	agtataa	897

&lt;210&gt; 131

&lt;211&gt; 298

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 131

Met	Ala	Ala	Ile	Cys	Gly	Arg	Leu	Gly	Ser	Gly	Thr	Gly	Asn	Ala	Leu
1				5				10					15		
Lys	Ala	Phe	Phe	Thr	Gln	Pro	Ser	Asn	Lys	Met	Ala	Arg	Val	Val	Asn

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<210> 132
<211> 897
<212> DNA
<213> Chlamydia
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<400> 132

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gttaaggctg	ccaagtctgc	tgccgaattg	accgcaaata	ttttggaaca	agctggaggc	180
gcgggctctt	ccgcacacat	tacagcttcc	caagtgtcca	aaggattagg	ggatgcgaga	240
actgtttctg	ctttatggga	tgcctttaac	ggagcgttgc	caggaacagt	tcaaagtgcg	300
caaagctctc	tctctttac	gaaagctgct	agtccagaac	cgcaagaagg	ggatgagggg	360
ctcgtagcag	atctttgtgt	gtctcataag	cgcagagcgg	ctcgcgctgt	ctgtagcttc	420
atcggaggaa	ttacctacct	cgcgacattc	ggagctatcc	gtccgattct	gtttgtcaac	480
aaaatgctgg	cgcaaccgtt	tctttcttcc	caaactaaag	caaatatggg	atcttctggt	540
agctatatta	tggcggctaa	ccatgcagcg	tttgtggtgg	gttctggact	cgctatcagt	600
gcggaaagag	cagattgcga	agcccgcctc	gctcgtattg	cgagagaaga	gtcgtcactc	660
gaattgtcgg	gagaggaaaa	tgettgtgag	aggagagtcg	ctggagagaa	agccaagacg	720
ttcacgcgcg	tcaagtatgc	actcctcact	atgctcgaga	agtttttgga	atgcgttgcc	780
gacgttttca	aattggtgcc	gttgccattt	acaatgggta	tctgttgcgt	tgtggtcgcg	840
ggatgtacgt	tcacttctgc	agttattgga	ttgtggactt	tctqcaacag	agtataaa	897

<210> 133  
 <211> 298  
 <212> PRT  
 <213> Chlamydia

<400> 133  
 Met Ala Ala Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu  
 1 5 10 15  
 Lys Ala Phe Phe Thr Gln Pro Ser Asn Lys Met Ala Arg Val Val Asn  
 20 25 30  
 Lys Thr Lys Gly Met Asp Lys Thr Val Lys Val Ala Lys Ser Ala Ala  
 35 40 45  
 Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser  
 50 55 60  
 Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Ala Arg  
 65 70 75 80  
 Thr Val Leu Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr  
 85 90 95  
 Val Gln Ser Ala Gln Ser Phe Phe Ser Tyr Met Lys Ala Ala Ser Gln  
 100 105 110  
 Lys Pro Gln Glu Gly Asp Glu Gly Leu Val Ala Asp Leu Cys Val Ser  
 115 120 125  
 His Lys Arg Arg Ala Ala Ala Ala Val Cys Ser Phe Ile Gly Gly Ile  
 130 135 140  
 Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile Leu Phe Val Asn  
 145 150 155 160  
 Lys Met Leu Ala Gln Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met  
 165 170 175  
 Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Phe Val  
 180 185 190  
 Val Gly Ser Gly Leu Ala Ile Ser Ala Glu Arg Ala Asp Cys Glu Ala  
 195 200 205  
 Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Ser Leu Glu Leu Ser Gly  
 210 215 220  
 Glu Glu Asn Ala Cys Glu Arg Arg Val Ala Gly Glu Lys Ala Lys Thr  
 225 230 235 240  
 Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu  
 245 250 255  
 Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met  
 260 265 270  
 Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Val  
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<210> 134  
 <211> 897  
 <212> DNA  
 <213> Chlamydia

<400> 134  
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 attaagggttg ccaagtctgc tgccgaattg accgcaaata ttttggaaca agctggagggc 180  
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 caaagcttct tctctcacat gaaagctgct agtcagaaaa cgcaagaagg ggatgagggg 360  
 ctcacagcag atctttgtgt gtctcataag cgcagagcgg ctgctggctgt ctgtagcatc 420

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gcggaagag cagattgcga agcccgctgc gctcgtattg cgagagaaga gtcgttactc 660
gaaatgccgg gagaggaaaa tgcttgcgag aagaaagtcg ctggagagaa agccaagacg 720
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gacgttttca aattggtgcc gctgcctatt acaatgggta ttcgtgcgat tgtggctgct 840
ggatgtacgt tcacttctgc aattattgga ttgtgcactt tctgcgccag agcataa 897

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&lt;210&gt; 135

&lt;211&gt; 298

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 135

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Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu
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Lys Ala Phe Phe Thr Gln Pro Asn Asn Lys Met Ala Arg Val Val Asn
      20          25          30
Lys Thr Lys Gly Met Asp Lys Thr Ile Lys Val Ala Lys Ser Ala Ala
      35          40          45
Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser
      50          55          60
Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Ala Arg
      65          70          75          80
Thr Val Val Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr
      85          90          95
Val Gln Ser Ala Gln Ser Phe Phe Ser His Met Lys Ala Ala Ser Gln
      100         105         110
Lys Thr Gln Glu Gly Asp Glu Gly Leu Thr Ala Asp Leu Cys Val Ser
      115         120         125
His Lys Arg Arg Ala Ala Ala Ala Val Cys Ser Ile Ile Gly Gly Ile
      130         135         140
Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile Leu Phe Val Asn
      145         150         155         160
Lys Met Leu Ala Lys Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met
      165         170         175
Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val
      180         185         190
Val Gly Ala Gly Leu Ala Ile Ser Ala Glu Arg Ala Asp Cys Glu Ala
      195         200         205
Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Leu Leu Glu Met Pro Gly
      210         215         220
Glu Glu Asn Ala Cys Glu Lys Lys Val Ala Gly Glu Lys Ala Lys Thr
      225         230         235         240
Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu
      245         250         255
Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met
      260         265         270
Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Ile
      275         280         285
Ile Gly Leu Cys Thr Phe Cys Ala Arg Ala
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&lt;210&gt; 136

&lt;211&gt; 882

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

<400> 136  
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 ataaagggtt ggaagtctgc tgctgaatta acggcgagta ttttagagca aactgggggg 180  
 gcagggactg atgcacatgt tacggcggcc aagggtgtcta aagcacttgg ggacgcgcga 240  
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<210> 137

<211> 293

<212> PRT

<213> Chlamydia

<400> 137  
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 Asn Ala Phe Phe Thr Arg Pro Gly Asn Lys Leu Ser Arg Phe Val Asn  
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 Ser Ala Lys Gly Leu Asp Arg Ser Ile Lys Val Gly Lys Ser Ala Ala  
 35 40 45  
 Glu Leu Thr Ala Ser Ile Leu Glu Gln Thr Gly Gly Ala Gly Thr Asp  
 50 55 60  
 Ala His Val Thr Ala Ala Lys Val Ser Lys Ala Leu Gly Asp Ala Arg  
 65 70 75 80  
 Thr Val Met Ala Leu Gly Asn Val Phe Asn Gly Ser Val Pro Ala Thr  
 85 90 95  
 Ile Gln Ser Ala Arg Ser Cys Leu Ala His Leu Arg Ala Ala Gly Lys  
 100 105 110  
 Glu Glu Glu Thr Cys Ser Lys Val Lys Asp Leu Cys Val Ser His Arg  
 115 120 125  
 Arg Arg Ala Ala Ala Glu Ala Cys Asn Val Ile Gly Gly Ala Thr Tyr  
 130 135 140  
 Ile Thr Thr Phe Gly Ala Ile Arg Pro Thr Leu Leu Val Asn Lys Leu  
 145 150 155 160  
 Leu Ala Lys Pro Phe Leu Ser Ser Gln Ala Lys Glu Gly Leu Gly Ala  
 165 170 175  
 Ser Val Gly Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val Leu Gly  
 180 185 190  
 Ser Ala Leu Ser Ile Ser Ala Glu Arg Ala Asp Cys Glu Glu Arg Cys  
 195 200 205  
 Asp Arg Ile Arg Cys Ser Glu Asp Gly Glu Ile Cys Glu Gly Asn Lys  
 210 215 220  
 Leu Thr Ala Ile Ser Glu Glu Lys Ala Arg Ser Trp Thr Leu Ile Lys  
 225 230 235 240  
 Tyr Arg Phe Leu Thr Met Ile Glu Lys Leu Phe Glu Met Val Ala Asp  
 245 250 255  
 Ile Phe Lys Leu Ile Pro Leu Pro Ile Ser His Gly Ile Arg Ala Ile  
 260 265 270



Val Ala Ala Gly Cys Thr Leu Thr Ser Ala Val Ile Gly Leu Gly Thr  
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 Phe Trp Ser Arg Ala  
           290

<210> 138  
 <211> 16  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Made in a lab

<400> 138  
 Asp Leu Cys Val Ser His Lys Arg Arg Ala Ala Ala Ala Val Cys Ser  
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<210> 139  
 <211> 16  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Made in a lab

<400> 139  
 Arg Ala Ala Ala Val Cys Ser Phe Ile Gly Gly Ile Thr Tyr Leu  
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<210> 140  
 <211> 18  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Made in a lab

<400> 140  
 Cys Ser Phe Ile Gly Gly Ile Thr Tyr Leu Ala Thr Phe Gly Ala Ile  
   1                                  5                                  10                                  15  
 Arg Pro

<210> 141  
 <211> 18  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Made in a lab

<400> 141  
 Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile Leu Phe Val Asn Lys  
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 Met Leu

<210> 142

<211> 18  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 142  
Arg Pro Ile Leu Phe Val Asn Lys Met Leu Ala Gln Pro Phe Leu Ser  
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<210> 143  
<211> 17  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 143  
Met Leu Ala Gln Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met Gly  
1 5 10 15  
Ser

<210> 144  
<211> 10  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 144  
Cys Ser Phe Ile Gly Gly Ile Thr Tyr Leu  
1 5 10

<210> 145  
<211> 9  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 145  
Ser Phe Ile Gly Gly Ile Thr Tyr Leu  
1 5

<210> 146  
<211> 8  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 146  
Phe Ile Gly Gly Ile Thr Tyr Leu  
1 5

<210> 147  
<211> 9  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 147  
Cys Ser Phe Ile Gly Gly Ile Thr Tyr  
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<210> 148  
<211> 8  
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<220>  
<223> Made in a lab

<400> 148  
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1 5

<210> 149  
<211> 10  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 149  
Cys Ser Ile Ile Gly Gly Ile Thr Tyr Leu  
1 5 10

<210> 150  
<211> 10  
<212> PRT  
<213> Artificial Sequence

<220>  
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<400> 150  
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<210> 151  
<211> 9  
<212> PRT  
<213> Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 151

Gly Phe Ile Gly Gly Ile Thr Tyr Leu  
1 5

&lt;210&gt; 152

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 152

Gln Ile Phe Val Cys Leu Ile Ser Ala Glu Arg Leu Arg Leu Arg Leu  
1 5 10 15  
Ser Val Ala Ser  
20

&lt;210&gt; 153

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 153

Glu Arg Leu Arg Leu Arg Leu Ser Val Ala Ser Ser Glu Glu Leu Pro  
1 5 10 15  
Thr Ser Arg His  
20

&lt;210&gt; 154

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 154

Ala Ser Ser Glu Glu Leu Pro Thr Ser Arg His Ser Glu Leu Ser Val  
1 5 10 15  
Arg Phe Cys Leu  
20

&lt;210&gt; 155

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 155

Arg His Ser Glu Leu Ser Val Arg Phe Cys Leu Ser Thr Lys Cys Trp  
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 Arg Asn Arg Phe  
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<210> 156  
 <211> 20  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Made in a lab

<400> 156  
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<210> 157  
 <211> 53  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Made in a lab

<400> 157  
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 Ser Ser Glu Glu Leu Pro Thr Ser Arg His Ser Glu Leu Ser Val Arg  
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 Leu Lys Gln Ile Trp  
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<210> 158  
 <211> 52  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> Made in a lab

<400> 158  
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 35 40 45  
 Lys Ala Asn Met  
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<210> 159  
 <211> 24  
 <212> DNA

<213> Chlamydia

<400> 159  
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<210> 160  
<211> 24  
<212> DNA  
<213> Chlamydia

<400> 160  
ttaagaaatt taaaaaatcc ctta 24

<210> 161  
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<212> DNA  
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<400> 161  
ggtataatat ctctctaaat ttg 24

<210> 162  
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<212> DNA  
<213> Chlamydia

<400> 162  
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<210> 163  
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<212> DNA  
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<400> 163  
ttttgaagca ggtagggtgaa tatg 24

<210> 164  
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<212> DNA  
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<400> 164  
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<210> 165  
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<212> DNA  
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<400> 165  
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<210> 166  
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<212> DNA  
<213> Chlamydia

<400> 166  
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<210> 167  
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<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 167  
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<210> 168  
<211> 9  
<212> PRT  
<213> Artificial Sequence

<220>  
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<400> 168  
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<210> 169  
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<212> DNA  
<213> Chlamydia

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aatcatgtcg tctgtacatt ttttgaggac tgtaccatgg agagcctctt tctgtctctt 180  
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tag						2643

&lt;210&gt; 170

&lt;211&gt; 2949

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 170

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&lt;210&gt; 171

&lt;211&gt; 2895

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 171

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&lt;210&gt; 172

&lt;211&gt; 4593

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 172

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&lt;211&gt; 5331

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 173

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&lt;210&gt; 174

&lt;211&gt; 5265

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 174

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&lt;210&gt; 175

&lt;211&gt; 880

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; VARIANT

&lt;222&gt; (1)...(880)

&lt;223&gt; Xaa = Any Amino Acid

&lt;400&gt; 175

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Ala Ile Met Arg Pro Asp His Met Asn Phe Cys Cys Leu Cys Ala Ala
 1           5           10           15
Ile Leu Ser Ser Thr Ala Val Leu Phe Gly Gln Asp Pro Leu Gly Glu
          20           25           30
Thr Ala Leu Leu Thr Lys Asn Pro Asn His Val Val Cys Thr Phe Phe
          35           40           45
Glu Asp Cys Thr Met Glu Ser Leu Phe Pro Ala Leu Cys Ala His Ala
 50           55           60
Ser Gln Asp Asp Pro Leu Tyr Val Leu Gly Asn Ser Tyr Cys Trp Phe
 65           70           75           80
Val Ser Lys Leu His Ile Thr Asp Pro Lys Glu Ala Leu Phe Lys Glu
          85           90           95
Lys Gly Asp Leu Ser Ile Gln Asn Phe Arg Phe Leu Ser Phe Thr Asp
          100          105          110
Cys Ser Ser Lys Glu Ser Ser Pro Ser Ile Ile His Gln Lys Asn Gly
          115          120          125
Gln Leu Ser Leu Arg Asn Asn Gly Ser Met Ser Phe Cys Arg Asn His
          130          135          140
Ala Glu Gly Ser Gly Gly Ala Ile Ser Ala Asp Ala Phe Ser Leu Gln
          145          150          155          160
His Asn Tyr Leu Phe Thr Ala Phe Glu Glu Asn Ser Ser Lys Gly Asn
          165          170          175
Gly Gly Ala Ile Gln Ala Gln Thr Phe Ser Leu Ser Arg Asn Val Ser
          180          185          190
Pro Ile Ser Phe Ala Arg Asn Arg Ala Asp Leu Asn Gly Gly Ala Ile
          195          200          205
Cys Cys Ser Asn Leu Ile Cys Ser Gly Asn Val Asn Pro Leu Phe Phe
          210          215          220
Thr Gly Asn Ser Ala Thr Asn Gly Gly Ala Ile Cys Cys Ile Ser Asp
          225          230          235          240
Leu Asn Thr Ser Glu Lys Gly Ser Leu Ser Leu Ala Cys Asn Gln Glu
          245          250          255
Thr Leu Phe Ala Ser Asn Ser Ala Lys Glu Lys Gly Gly Ala Ile Tyr
          260          265          270
Ala Lys His Met Val Leu Arg Tyr Asn Gly Pro Val Ser Phe Ile Asn
          275          280          285
Asn Ser Ala Lys Ile Gly Gly Ala Ile Ala Ile Gln Ser Gly Gly Ser
          290          295          300
Leu Ser Ile Leu Ala Gly Glu Gly Ser Val Leu Phe Gln Asn Asn Ser
          305          310          315          320

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Gln Arg Thr Ser Asp Gln Gly Leu Val Arg Asn Ala Ile Tyr Leu Xaa  
 325 330 335  
 Lys Asp Ala Ile Leu Ser Ser Leu Glu Ala Arg Asn Gly Asp Ile Leu  
 340 345 350  
 Phe Phe Asp Pro Ile Val Gln Glu Ser Ser Ser Lys Glu Ser Pro Leu  
 355 360 365  
 Pro Ser Ser Leu Gln Ala Ser Val Thr Ser Pro Thr Pro Ala Thr Ala  
 370 375 380  
 Ser Pro Leu Val Ile Gln Thr Ser Ala Asn Arg Ser Val Ile Phe Ser  
 385 390 395 400  
 Ser Glu Arg Leu Ser Glu Glu Lys Thr Pro Asp Asn Leu Thr Ser  
 405 410 415  
 Gln Leu Gln Gln Pro Ile Glu Leu Lys Ser Gly Arg Leu Val Leu Lys  
 420 425 430  
 Asp Arg Ala Val Leu Ser Ala Pro Ser Leu Ser Gln Asp Pro Gln Ala  
 435 440 445  
 Leu Leu Ile Met Glu Ala Gly Thr Ser Leu Lys Thr Ser Ser Asp Leu  
 450 455 460  
 Lys Leu Ala Thr Leu Ser Ile Pro Leu His Ser Leu Asp Thr Glu Lys  
 465 470 475 480  
 Ser Val Thr Ile His Ala Pro Asn Leu Ser Ile Gln Lys Ile Phe Leu  
 485 490 495  
 Ser Asn Ser Gly Asp Glu Asn Phe Tyr Glu Asn Val Glu Leu Leu Ser  
 500 505 510  
 Lys Glu Gln Asn Asn Ile Pro Leu Leu Thr Leu Pro Lys Glu Gln Ser  
 515 520 525  
 His Leu His Leu Pro Asp Gly Asn Leu Ser Ser His Phe Gly Tyr Gln  
 530 535 540  
 Gly Asp Trp Thr Phe Ser Trp Lys Asp Ser Asp Glu Gly His Ser Leu  
 545 550 555 560  
 Ile Ala Asn Trp Thr Pro Lys Asn Tyr Val Pro His Pro Glu Arg Gln  
 565 570 575  
 Ser Thr Leu Val Ala Asn Thr Leu Trp Asn Thr Tyr Ser Asp Met Gln  
 580 585 590  
 Ala Val Gln Ser Met Ile Asn Thr Thr Ala His Gly Gly Ala Tyr Leu  
 595 600 605  
 Phe Gly Thr Trp Gly Ser Ala Val Ser Asn Leu Phe Tyr Val His Asp  
 610 615 620  
 Ser Ser Gly Lys Pro Ile Asp Asn Trp His His Arg Ser Leu Gly Tyr  
 625 630 635 640  
 Leu Phe Gly Ile Ser Thr His Ser Leu Asp Asp His Ser Phe Cys Leu  
 645 650 655  
 Ala Ala Gly Gln Leu Leu Gly Lys Ser Ser Asp Ser Phe Ile Thr Ser  
 660 665 670  
 Thr Glu Thr Thr Ser Tyr Ile Ala Thr Val Gln Ala Gln Leu Ala Thr  
 675 680 685  
 Ser Leu Met Lys Ile Ser Ala Gln Ala Cys Tyr Asn Glu Ser Ile His  
 690 695 700  
 Glu Leu Lys Thr Lys Tyr Arg Ser Phe Ser Lys Glu Gly Phe Gly Ser  
 705 710 715 720  
 Trp His Ser Val Ala Val Ser Gly Glu Val Cys Ala Ser Ile Pro Ile  
 725 730 735  
 Val Ser Asn Gly Ser Gly Leu Phe Ser Ser Phe Ser Ile Phe Ser Lys  
 740 745 750  
 Leu Gln Gly Phe Ser Gly Thr Gln Asp Gly Phe Glu Glu Ser Ser Gly  
 755 760 765  
 Glu Ile Arg Ser Phe Ser Ala Ser Ser Phe Arg Asn Ile Ser Leu Pro  
 770 775 780



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Ile Gly Ile Thr Phe Glu Lys Lys Ser Gln Lys Thr Arg Thr Tyr Tyr
785              790              795              800
Tyr Phe Leu Gly Ala Tyr Ile Gln Asp Leu Lys Arg Asp Val Glu Ser
              805              810              815
Gly Pro Val Val Leu Leu Lys Asn Ala Val Ser Trp Asp Ala Pro Met
              820              825              830
Ala Asn Leu Asp Ser Arg Ala Tyr Met Phe Arg Leu Thr Asn Gln Arg
              835              840              845
Ala Leu His Arg Leu Gln Thr Leu Leu Asn Val Ser Cys Val Leu Arg
              850              855              860
Gly Gln Ser His Ser Tyr Ser Leu Asp Leu Gly Thr Thr Tyr Arg Phe
865              870              875              880

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&lt;210&gt; 176

&lt;211&gt; 982

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; VARIANT

&lt;222&gt; (1)...(982)

&lt;223&gt; Xaa = Any Amino Acid

&lt;400&gt; 176

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Met Ile Pro Gln Gly Ile Tyr Asp Gly Glu Thr Leu Thr Val Ser Phe
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Pro Tyr Thr Val Ile Gly Asp Pro Ser Gly Thr Thr Val Phe Ser Ala
              20              25              30
Gly Glu Leu Thr Leu Lys Asn Leu Asp Asn Ser Ile Ala Ala Leu Pro
              35              40              45
Leu Ser Cys Phe Gly Asn Leu Leu Gly Ser Phe Thr Val Leu Gly Arg
              50              55              60
Gly His Ser Leu Thr Phe Glu Asn Ile Arg Thr Ser Thr Asn Gly Ala
65              70              75              80
Ala Leu Ser Asn Ser Ala Ala Asp Gly Leu Phe Thr Ile Glu Gly Phe
              85              90              95
Lys Glu Leu Ser Phe Ser Asn Cys Asn Ser Leu Leu Ala Val Leu Pro
              100             105             110
Ala Ala Thr Thr Asn Lys Gly Ser Gln Thr Pro Thr Thr Thr Ser Thr
              115             120             125
Pro Ser Asn Gly Thr Ile Tyr Ser Lys Thr Asp Leu Leu Leu Leu Asn
130             135             140
Asn Glu Lys Phe Ser Phe Tyr Ser Asn Leu Val Ser Gly Asp Gly Gly
145             150             155             160
Ala Ile Asp Ala Lys Ser Leu Thr Val Gln Gly Ile Ser Lys Leu Cys
              165             170             175
Val Phe Gln Glu Asn Thr Ala Gln Ala Asp Gly Gly Ala Cys Gln Val
              180             185             190
Val Thr Ser Phe Ser Ala Met Ala Asn Glu Ala Pro Ile Ala Phe Val
              195             200             205
Ala Asn Val Ala Gly Val Arg Gly Gly Gly Ile Ala Ala Val Gln Asp
210             215             220
Gly Gln Gln Gly Val Ser Ser Ser Thr Ser Thr Glu Asp Pro Val Val
225             230             235             240
Ser Phe Ser Arg Asn Thr Ala Val Glu Phe Asp Gly Asn Val Ala Arg
              245             250             255
Val Gly Gly Gly Ile Tyr Ser Tyr Gly Asn Val Ala Phe Leu Asn Asn
260             265             270

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Gly	Lys	Thr	Leu	Phe	Leu	Asn	Asn	Val	Ala	Ser	Pro	Val	Tyr	Ile	Ala		
		275					280					285					
Ala	Lys	Gln	Pro	Thr	Ser	Gly	Gln	Ala	Ser	Asn	Thr	Ser	Asn	Asn	Tyr		
	290					295					300						
Gly	Asp	Gly	Gly	Ala	Ile	Phe	Cys	Lys	Asn	Gly	Ala	Gln	Ala	Gly	Ser		
305					310					315					320		
Asn	Asn	Ser	Gly	Ser	Val	Ser	Phe	Asp	Gly	Glu	Gly	Val	Val	Phe	Phe		
			325						330					335			
Ser	Ser	Asn	Val	Ala	Ala	Gly	Lys	Gly	Gly	Ala	Ile	Tyr	Ala	Lys	Lys		
		340					345						350				
Leu	Ser	Val	Ala	Asn	Cys	Gly	Pro	Val	Gln	Phe	Leu	Arg	Asn	Ile	Ala		
	355						360					365					
Asn	Asp	Gly	Gly	Ala	Ile	Tyr	Leu	Gly	Glu	Ser	Gly	Glu	Leu	Ser	Leu		
370					375					380							
Ser	Ala	Asp	Tyr	Gly	Asp	Ile	Ile	Phe	Asp	Gly	Asn	Leu	Lys	Arg	Thr		
385				390					395						400		
Ala	Lys	Glu	Asn	Ala	Ala	Asp	Val	Asn	Gly	Val	Thr	Val	Ser	Ser	Gln		
			405						410						415		
Ala	Ile	Ser	Met	Gly	Ser	Gly	Gly	Lys	Ile	Thr	Thr	Leu	Arg	Ala	Lys		
		420					425						430				
Ala	Gly	His	Gln	Ile	Leu	Phe	Asn	Asp	Pro	Ile	Glu	Met	Ala	Asn	Gly		
	435					440						445					
Asn	Asn	Gln	Pro	Ala	Gln	Ser	Ser	Lys	Leu	Leu	Lys	Ile	Asn	Asp	Gly		
450					455					460							
Glu	Gly	Tyr	Thr	Gly	Asp	Ile	Val	Phe	Ala	Asn	Gly	Ser	Ser	Thr	Leu		
465				470					475						480		
Tyr	Gln	Asn	Val	Thr	Ile	Glu	Gln	Gly	Arg	Ile	Val	Leu	Arg	Glu	Lys		
		485							490					495			
Ala	Lys	Leu	Ser	Val	Asn	Ser	Leu	Ser	Gln	Thr	Gly	Gly	Ser	Leu	Tyr		
		500					505					510					
Met	Glu	Ala	Gly	Ser	Thr	Leu	Asp	Phe	Val	Thr	Pro	Gln	Pro	Pro	Gln		
	515					520						525					
Gln	Pro	Pro	Ala	Ala	Asn	Gln	Leu	Ile	Thr	Leu	Ser	Asn	Leu	His	Leu		
530					535						540						
Ser	Leu	Ser	Ser	Leu	Leu	Ala	Asn	Asn	Ala	Val	Thr	Asn	Pro	Pro	Thr		
545				550					555						560		
Asn	Pro	Pro	Ala	Gln	Asp	Ser	His	Pro	Ala	Val	Ile	Gly	Ser	Thr	Thr		
			565					570						575			
Ala	Gly	Ser	Val	Thr	Ile	Ser	Gly	Pro	Ile	Phe	Phe	Glu	Asp	Leu	Asp		
		580					585					590					
Asp	Thr	Ala	Tyr	Asp	Arg	Tyr	Asp	Trp	Leu	Gly	Ser	Asn	Gln	Lys	Ile		
	595					600						605					
Asn	Val	Leu	Lys	Leu	Gln	Leu	Gly	Thr	Lys	Pro	Pro	Ala	Asn	Ala	Pro		
610					615					620							
Ser	Asp	Leu	Thr	Leu	Gly	Asn	Glu	Met	Pro	Lys	Tyr	Gly	Tyr	Gln	Gly		
625				630					635						640		
Ser	Trp	Lys	Leu	Ala	Trp	Asp	Pro	Asn	Thr	Ala	Asn	Asn	Gly	Pro	Tyr		
			645					650						655			
Thr	Leu	Lys	Ala	Thr	Trp	Thr	Lys	Thr	Gly	Tyr	Asn	Pro	Gly	Pro	Glu		
		660					665						670				
Arg	Val	Ala	Ser	Leu	Val	Pro	Asn	Ser	Leu	Trp	Gly	Ser	Ile	Leu	Asp		
	675					680						685					
Ile	Arg	Ser	Ala	His	Ser	Ala	Ile	Gln	Ala	Ser	Val	Asp	Gly	Arg	Ser		
690					695					700							
Tyr	Cys	Arg	Gly	Leu	Trp	Val	Ser	Gly	Val	Ser	Asn	Phe	Phe	Tyr	His		
705				710					715						720		
Asp	Arg	Asp	Ala	Leu	Gly	Gln	Gly	Tyr	Arg	Tyr	Ile	Ser	Gly	Gly	Tyr		
			725					730						735			

Ser Leu Gly Ala Asn Ser Tyr Phe Gly Ser Ser Met Phe Gly Leu Ala  
                     740                    745                    750  
 Phe Thr Glu Val Phe Gly Arg Ser Lys Asp Tyr Val Val Cys Arg Ser  
                     755                    760                    765  
 Asn His His Ala Cys Ile Gly Ser Val Tyr Leu Ser Thr Gln Gln Ala  
                     770                    775                    780  
 Leu Cys Gly Ser Tyr Leu Phe Gly Asp Ala Phe Ile Arg Ala Ser Tyr  
                     785                    790                    795                    800  
 Gly Phe Gly Asn Gln His Met Lys Thr Ser Tyr Thr Phe Ala Glu Glu  
                     805                    810                    815  
 Ser Asp Val Arg Trp Asp Asn Asn Cys Leu Ala Gly Glu Ile Gly Ala  
                     820                    825                    830  
 Gly Leu Pro Ile Val Ile Thr Pro Ser Lys Leu Tyr Leu Asn Glu Leu  
                     835                    840                    845  
 Arg Pro Phe Val Gln Ala Glu Phe Ser Tyr Ala Asp His Glu Ser Phe  
                     850                    855                    860  
 Thr Glu Glu Gly Asp Gln Ala Arg Ala Phe Lys Ser Gly His Leu Leu  
                     865                    870                    875                    880  
 Asn Leu Ser Val Pro Val Gly Val Lys Phe Asp Arg Cys Ser Ser Thr  
                     885                    890                    895  
 His Pro Asn Lys Tyr Ser Phe Met Ala Ala Tyr Ile Cys Asp Ala Tyr  
                     900                    905                    910  
 Arg Thr Ile Ser Gly Thr Glu Thr Thr Leu Leu Ser His Gln Glu Thr  
                     915                    920                    925  
 Trp Thr Thr Asp Ala Phe His Leu Ala Arg His Gly Val Val Val Arg  
                     930                    935                    940  
 Gly Ser Met Tyr Ala Ser Leu Thr Ser Asn Ile Glu Val Tyr Gly His  
                     945                    950                    955                    960  
 Gly Arg Tyr Glu Tyr Arg Asp Ala Ser Arg Gly Tyr Gly Leu Ser Ala  
                     965                    970                    975  
 Gly Ser Lys Val Xaa Phe  
                     980

&lt;210&gt; 177

&lt;211&gt; 964

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 177

Met Lys Lys Ala Phe Phe Phe Phe Leu Ile Gly Asn Ser Leu Ser Gly  
   1                    5                    10                    15  
 Leu Ala Arg Glu Val Pro Ser Arg Ile Phe Leu Met Pro Asn Ser Val  
                     20                    25                    30  
 Pro Asp Pro Thr Lys Glu Ser Leu Ser Asn Lys Ile Ser Leu Thr Gly  
                     35                    40                    45  
 Asp Thr His Asn Leu Thr Asn Cys Tyr Leu Asp Asn Leu Arg Tyr Ile  
                     50                    55                    60  
 Leu Ala Ile Leu Gln Lys Thr Pro Asn Glu Gly Ala Ala Val Thr Ile  
                     65                    70                    75                    80  
 Thr Asp Tyr Leu Ser Phe Phe Asp Thr Gln Lys Glu Gly Ile Tyr Phe  
                     85                    90                    95  
 Ala Lys Asn Leu Thr Pro Glu Ser Gly Gly Ala Ile Gly Tyr Ala Ser  
                     100                    105                    110  
 Pro Asn Ser Pro Thr Val Glu Ile Arg Asp Thr Ile Gly Pro Val Ile  
                     115                    120                    125  
 Phe Glu Asn Asn Thr Cys Cys Arg Leu Phe Thr Trp Arg Asn Pro Tyr  
                     130                    135                    140  
 Ala Ala Asp Lys Ile Arg Glu Gly Gly Ala Ile His Ala Gln Asn Leu

145					150					155				160
Tyr	Ile	Asn	His	Asn	His	Asp	Val	Val	Gly	Phe	Met	Lys	Asn	Phe
				165					170					175
Tyr	Val	Gln	Gly	Gly	Ala	Ile	Ser	Thr	Ala	Asn	Thr	Phe	Val	Val
			180					185					190	
Glu	Asn	Gln	Ser	Cys	Phe	Leu	Phe	Met	Asp	Asn	Ile	Cys	Ile	Gln
			195					200				205		
Asn	Thr	Ala	Gly	Lys	Gly	Gly	Ala	Ile	Tyr	Ala	Gly	Thr	Ser	Asn
	210					215				220				
Phe	Glu	Ser	Asn	Asn	Cys	Asp	Leu	Phe	Phe	Ile	Asn	Asn	Ala	Cys
	225				230					235				240
Ala	Gly	Gly	Ala	Ile	Phe	Ser	Pro	Ile	Cys	Ser	Leu	Thr	Gly	Asn
				245					250					255
Gly	Asn	Ile	Val	Phe	Tyr	Asn	Asn	Arg	Cys	Phe	Lys	Asn	Val	Glu
			260					265					270	
Ala	Ser	Ser	Glu	Ala	Ser	Asp	Gly	Gly	Ala	Ile	Lys	Val	Thr	Thr
			275				280					285		
Leu	Asp	Val	Thr	Gly	Asn	Arg	Gly	Arg	Ile	Phe	Phe	Ser	Asp	Asn
	290					295						300		
Thr	Lys	Asn	Tyr	Gly	Gly	Ala	Ile	Tyr	Ala	Pro	Val	Val	Thr	Leu
	305				310					315				320
Asp	Asn	Gly	Pro	Thr	Tyr	Phe	Ile	Asn	Asn	Ile	Ala	Asn	Asn	Lys
				325					330					335
Gly	Ala	Ile	Tyr	Ile	Asp	Gly	Thr	Ser	Asn	Ser	Lys	Ile	Ser	Ala
			340				345					350		
Arg	His	Ala	Ile	Ile	Phe	Asn	Glu	Asn	Ile	Val	Thr	Asn	Val	Thr
		355					360					365		
Ala	Asn	Gly	Thr	Ser	Thr	Ser	Ala	Asn	Pro	Pro	Arg	Arg	Asn	Ala
	370						375				380			
Thr	Val	Ala	Ser	Ser	Ser	Gly	Glu	Ile	Leu	Leu	Gly	Ala	Gly	Ser
	385				390					395				400
Gln	Asn	Leu	Ile	Phe	Tyr	Asp	Pro	Ile	Glu	Val	Ser	Asn	Ala	Gly
				405					410				415	
Ser	Val	Ser	Phe	Asn	Lys	Glu	Ala	Asp	Gln	Thr	Gly	Ser	Val	Val
			420					425					430	
Ser	Gly	Ala	Thr	Val	Asn	Ser	Ala	Asp	Phe	His	Gln	Arg	Asn	Leu
		435					440				445			
Thr	Lys	Thr	Pro	Ala	Pro	Leu	Thr	Leu	Ser	Asn	Gly	Phe	Leu	Cys
	450					455					460			
Glu	Asp	His	Ala	Gln	Leu	Thr	Val	Asn	Arg	Phe	Thr	Gln	Thr	Gly
	465				470				475					480
Val	Val	Ser	Leu	Gly	Asn	Gly	Ala	Val	Leu	Ser	Cys	Tyr	Lys	Asn
				485					490					495
Thr	Gly	Asp	Ser	Ala	Ser	Asn	Ala	Ser	Ile	Thr	Leu	Lys	His	Ile
		500						505					510	
Leu	Asn	Leu	Ser	Ser	Ile	Leu	Lys	Ser	Gly	Ala	Glu	Ile	Pro	Leu
		515					520					525		
Trp	Val	Glu	Pro	Thr	Asn	Asn	Ser	Asn	Asn	Tyr	Thr	Ala	Asp	Thr
	530					535				540				
Ala	Thr	Phe	Ser	Leu	Ser	Asp	Val	Lys	Leu	Ser	Leu	Ile	Asp	Asp
	545					550			555					560
Gly	Asn	Ser	Pro	Tyr	Glu	Ser	Thr	Asp	Leu	Thr	His	Ala	Leu	Ser
				565				570						575
Gln	Pro	Met	Leu	Ser	Ile	Ser	Glu	Ala	Ser	Asp	Asn	Gln	Leu	Gln
		580						585				590		
Glu	Asn	Ile	Asp	Phe	Ser	Gly	Leu	Asn	Val	Pro	His	Tyr	Gly	Trp
		595					600					605		
Gly	Leu	Trp	Thr	Trp	Gly	Trp	Ala	Lys	Thr	Gln	Asp	Pro	Glu	Pro

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        610                615                620
Ser Ser Ala Thr Ile Thr Asp Pro Gln Lys Ala Asn Arg Phe His Arg
625                630                635                640
Thr Leu Leu Leu Thr Trp Leu Pro Ala Gly Tyr Val Pro Ser Pro Lys
        645                650                655
His Arg Ser Pro Leu Ile Ala Asn Thr Leu Trp Gly Asn Met Leu Leu
        660                665                670
Ala Thr Glu Ser Leu Lys Asn Ser Ala Glu Leu Thr Pro Ser Gly His
        675                680                685
Pro Phe Trp Gly Ile Thr Gly Gly Gly Leu Gly Met Met Val Tyr Gln
        690                695                700
Asp Pro Arg Glu Asn His Pro Gly Phe His Met Arg Ser Ser Gly Tyr
705                710                715                720
Ser Ala Gly Met Ile Ala Gly Gln Thr His Thr Phe Ser Leu Lys Phe
        725                730                735
Ser Gln Thr Tyr Thr Lys Leu Asn Glu Arg Tyr Ala Lys Asn Asn Val
        740                745                750
Ser Ser Lys Asn Tyr Ser Cys Gln Gly Glu Met Leu Phe Ser Leu Gln
        755                760                765
Glu Gly Phe Leu Leu Thr Lys Leu Val Gly Leu Tyr Ser Tyr Gly Asp
770                775                780
His Asn Cys His His Phe Tyr Thr Gln Gly Glu Asn Leu Thr Ser Gln
785                790                795                800
Gly Thr Phe Arg Ser Gln Thr Met Gly Gly Ala Val Phe Phe Asp Leu
        805                810                815
Pro Met Lys Pro Phe Gly Ser Thr His Ile Leu Thr Ala Pro Phe Leu
        820                825                830
Gly Ala Leu Gly Ile Tyr Ser Ser Leu Ser His Phe Thr Glu Val Gly
        835                840                845
Ala Tyr Pro Arg Ser Phe Ser Thr Lys Thr Pro Leu Ile Asn Val Leu
        850                855                860
Val Pro Ile Gly Val Lys Gly Ser Phe Met Asn Ala Thr His Arg Pro
865                870                875                880
Gln Ala Trp Thr Val Glu Leu Ala Tyr Gln Pro Val Leu Tyr Arg Gln
        885                890                895
Glu Pro Gly Ile Ala Thr Gln Leu Leu Ala Ser Lys Gly Ile Trp Phe
        900                905                910
Gly Ser Gly Ser Pro Ser Ser Arg His Ala Met Ser Tyr Lys Ile Ser
        915                920                925
Gln Gln Thr Gln Pro Leu Ser Trp Leu Thr Leu His Phe Gln Tyr His
        930                935                940
Gly Phe Tyr Ser Ser Ser Thr Phe Cys Asn Tyr Leu Asn Gly Glu Ile
945                950                955                960
Ala Leu Arg Phe

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<210> 178  
 <211> 1530  
 <212> PRT  
 <213> Chlamydia

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<400> 178
Met Ser Ser Glu Lys Asp Ile Lys Ser Thr Cys Ser Lys Phe Ser Leu
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Ser Val Val Ala Ile Leu Ala Ser Val Ser Gly Leu Ala Ser Cys
        20          25          30
Val Asp Leu His Ala Gly Gly Gln Ser Val Asn Glu Leu Val Tyr Val
        35          40          45

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Gly Pro Gln Ala Val Leu Leu Leu Asp Gln Ile Arg Asp Leu Phe Val  
 50 55 60  
 Gly Ser Lys Asp Ser Gln Ala Glu Gly Gln Tyr Arg Leu Ile Val Gly  
 65 70 75 80  
 Asp Pro Ser Ser Phe Gln Glu Lys Asp Ala Asp Thr Leu Pro Gly Lys  
 85 90 95  
 Val Glu Gln Ser Thr Leu Phe Ser Val Thr Asn Pro Val Val Phe Gln  
 100 105 110  
 Gly Val Asp Gln Gln Asp Gln Val Ser Ser Gln Gly Leu Ile Cys Ser  
 115 120 125  
 Phe Thr Ser Ser Asn Leu Asp Ser Pro Arg Asp Gly Glu Ser Phe Leu  
 130 135 140  
 Gly Ile Ala Phe Val Gly Asp Ser Ser Lys Ala Gly Ile Thr Leu Thr  
 145 150 155 160  
 Asp Val Lys Ala Ser Leu Ser Gly Ala Ala Leu Tyr Ser Thr Glu Asp  
 165 170 175  
 Leu Ile Phe Glu Lys Ile Lys Gly Gly Leu Glu Phe Ala Ser Cys Ser  
 180 185 190  
 Ser Leu Glu Gln Gly Gly Ala Cys Ala Ala Gln Ser Ile Leu Ile His  
 195 200 205  
 Asp Cys Gln Gly Leu Gln Val Lys His Cys Thr Thr Ala Val Asn Ala  
 210 215 220  
 Glu Gly Ser Ser Ala Asn Asp His Leu Gly Phe Gly Gly Gly Ala Phe  
 225 230 235 240  
 Phe Val Thr Gly Ser Leu Ser Gly Glu Lys Ser Leu Tyr Met Pro Ala  
 245 250 255  
 Gly Asp Met Val Val Ala Asn Cys Asp Gly Ala Ile Ser Phe Glu Gly  
 260 265 270  
 Asn Ser Ala Asn Phe Ala Asn Gly Gly Ala Ile Ala Ala Ser Gly Lys  
 275 280 285  
 Val Leu Phe Val Ala Asn Asp Lys Lys Thr Ser Phe Ile Glu Asn Arg  
 290 295 300  
 Ala Leu Ser Gly Gly Ala Ile Ala Ala Ser Ser Asp Ile Ala Phe Gln  
 305 310 315 320  
 Asn Cys Ala Glu Leu Val Phe Lys Gly Asn Cys Ala Ile Gly Thr Glu  
 325 330 335  
 Asp Lys Gly Ser Leu Gly Gly Gly Ala Ile Ser Ser Leu Gly Thr Val  
 340 345 350  
 Leu Leu Gln Gly Asn His Gly Ile Thr Cys Asp Lys Asn Glu Ser Ala  
 355 360 365  
 Ser Gln Gly Gly Ala Ile Phe Gly Lys Asn Cys Gln Ile Ser Asp Asn  
 370 375 380  
 Glu Gly Pro Val Val Phe Arg Asp Ser Thr Ala Cys Leu Gly Gly Gly  
 385 390 395 400  
 Ala Ile Ala Ala Gln Glu Ile Val Ser Ile Gln Asn Asn Gln Ala Gly  
 405 410 415  
 Ile Ser Phe Glu Gly Gly Lys Ala Ser Phe Gly Gly Gly Ile Ala Cys  
 420 425 430  
 Gly Ser Phe Ser Ser Ala Gly Gly Ala Ser Val Leu Gly Thr Ile Asp  
 435 440 445  
 Ile Ser Lys Asn Leu Gly Ala Ile Ser Phe Ser Arg Thr Leu Cys Thr  
 450 455 460  
 Thr Ser Asp Leu Gly Gln Met Glu Tyr Gln Gly Gly Gly Ala Leu Phe  
 465 470 475 480  
 Gly Glu Asn Ile Ser Leu Ser Glu Asn Ala Gly Val Leu Thr Phe Lys  
 485 490 495  
 Asp Asn Ile Val Lys Thr Phe Ala Ser Asn Gly Lys Ile Leu Gly Gly  
 500 505 510

Gly	Ala	Ile	Leu	Ala	Thr	Gly	Lys	Val	Glu	Ile	Thr	Asn	Asn	Ser	Gly
	515						520					525			
Gly	Ile	Ser	Phe	Thr	Gly	Asn	Ala	Arg	Ala	Pro	Gln	Ala	Leu	Pro	Thr
	530					535					540				
Gln	Glu	Glu	Phe	Pro	Leu	Phe	Ser	Lys	Lys	Glu	Gly	Arg	Pro	Leu	Ser
545					550					555					560
Ser	Gly	Tyr	Ser	Gly	Gly	Gly	Ala	Ile	Leu	Gly	Arg	Glu	Val	Ala	Ile
				565					570					575	
Leu	His	Asn	Ala	Ala	Val	Val	Phe	Glu	Gln	Asn	Arg	Leu	Gln	Cys	Ser
			580					585					590		
Glu	Glu	Glu	Ala	Thr	Leu	Leu	Gly	Cys	Cys	Gly	Gly	Gly	Ala	Val	His
		595					600					605			
Gly	Met	Asp	Ser	Thr	Ser	Ile	Val	Gly	Asn	Ser	Ser	Val	Arg	Phe	Gly
	610					615					620				
Asn	Asn	Tyr	Ala	Met	Gly	Gln	Gly	Val	Ser	Gly	Gly	Ala	Leu	Leu	Ser
625					630					635					640
Lys	Thr	Val	Gln	Leu	Ala	Gly	Asn	Gly	Ser	Val	Asp	Phe	Ser	Arg	Asn
				645					650					655	
Ile	Ala	Ser	Leu	Gly	Gly	Gly	Ala	Leu	Gln	Ala	Ser	Glu	Gly	Asn	Cys
			660					665						670	
Glu	Leu	Val	Asp	Asn	Gly	Tyr	Val	Leu	Phe	Arg	Asp	Asn	Arg	Gly	Arg
		675					680					685			
Val	Tyr	Gly	Gly	Ala	Ile	Ser	Cys	Leu	Arg	Gly	Asp	Val	Val	Ile	Ser
	690					695					700				
Gly	Asn	Lys	Gly	Arg	Val	Glu	Phe	Lys	Asp	Asn	Ile	Ala	Thr	Arg	Leu
705					710					715					720
Tyr	Val	Glu	Glu	Thr	Val	Glu	Lys	Val	Glu	Glu	Val	Glu	Pro	Ala	Pro
				725					730					735	
Glu	Gln	Lys	Asp	Asn	Asn	Glu	Leu	Ser	Phe	Leu	Gly	Ser	Val	Glu	Gln
			740					745					750		
Ser	Phe	Ile	Thr	Ala	Ala	Asn	Gln	Ala	Leu	Phe	Ala	Ser	Glu	Asp	Gly
		755					760					765			
Asp	Leu	Ser	Pro	Glu	Ser	Ser	Ile	Ser	Ser	Glu	Glu	Leu	Ala	Lys	Arg
	770					775					780				
Arg	Glu	Cys	Ala	Gly	Gly	Ala	Ile	Phe	Ala	Lys	Arg	Val	Arg	Ile	Val
785					790					795					800
Asp	Asn	Gln	Glu	Ala	Val	Val	Phe	Ser	Asn	Asn	Phe	Ser	Asp	Ile	Tyr
				805					810					815	
Gly	Gly	Ala	Ile	Phe	Thr	Gly	Ser	Leu	Arg	Glu	Glu	Asp	Lys	Leu	Asp
			820					825					830		
Gly	Gln	Ile	Pro	Glu	Val	Leu	Ile	Ser	Gly	Asn	Ala	Gly	Asp	Val	Val
		835						840				845			
Phe	Ser	Gly	Asn	Ser	Ser	Lys	Arg	Asp	Glu	His	Leu	Pro	His	Thr	Gly
	850					855					860				
Gly	Gly	Ala	Ile	Cys	Thr	Gln	Asn	Leu	Thr	Ile	Ser	Gln	Asn	Thr	Gly
865					870					875					880
Asn	Val	Leu	Phe	Tyr	Asn	Asn	Val	Ala	Cys	Ser	Gly	Gly	Ala	Val	Arg
				885					890					895	
Ile	Glu	Asp	His	Gly	Asn	Val	Leu	Leu	Glu	Ala	Phe	Gly	Gly	Asp	Ile
		900					905						910		
Val	Phe	Lys	Gly	Asn	Ser	Ser	Phe	Arg	Ala	Gln	Gly	Ser	Asp	Ala	Ile
		915					920					925			
Tyr	Phe	Ala	Gly	Lys	Glu	Ser	His	Ile	Thr	Ala	Leu	Asn	Ala	Thr	Glu
	930					935					940				
Gly	His	Ala	Ile	Val	Phe	His	Asp	Ala	Leu	Val	Phe	Glu	Asn	Leu	Lys
945					950					955					960
Glu	Arg	Lys	Ser	Ala	Glu	Val	Leu	Leu	Ile	Asn	Ser	Arg	Glu	Asn	Pro
				965					970					975	

Gly Tyr Thr Gly Ser Ile Arg Phe Leu Glu Ala Glu Ser Lys Val Pro  
                   980                  985                  990  
 Gln Cys Ile His Val Gln Gln Gly Ser Leu Glu Leu Leu Asn Gly Ala  
                   995                  1000                  1005  
 Thr Leu Cys Ser Tyr Gly Phe Lys Gln Asp Ala Gly Ala Lys Leu Val  
                   1010                  1015                  1020  
 Leu Ala Ala Gly Ser Lys Leu Lys Ile Leu Asp Ser Gly Thr Pro Val  
                   1025                  1030                  1035                  1040  
 Gln Gly His Ala Ile Ser Lys Pro Glu Ala Glu Ile Glu Ser Ser Ser  
                   1045                  1050                  1055  
 Glu Pro Glu Gly Ala His Ser Leu Trp Ile Ala Lys Asn Ala Gln Thr  
                   1060                  1065                  1070  
 Thr Val Pro Met Val Asp Ile His Thr Ile Ser Val Asp Leu Ala Ser  
                   1075                  1080                  1085  
 Phe Ser Ser Ser Gln Gln Glu Gly Thr Val Glu Ala Pro Gln Val Ile  
                   1090                  1095                  1100  
 Val Pro Gly Gly Ser Tyr Val Arg Ser Gly Glu Leu Asn Leu Glu Leu  
                   1105                  1110                  1115                  1120  
 Val Asn Thr Thr Gly Thr Gly Tyr Glu Asn His Ala Leu Leu Lys Asn  
                   1125                  1130                  1135  
 Glu Ala Lys Val Pro Leu Met Ser Phe Val Ala Ser Ser Asp Glu Ala  
                   1140                  1145                  1150  
 Ser Ala Glu Ile Ser Asn Leu Ser Val Ser Asp Leu Gln Ile His Val  
                   1155                  1160                  1165  
 Ala Thr Pro Glu Ile Glu Glu Asp Thr Tyr Gly His Met Gly Asp Trp  
                   1170                  1175                  1180  
 Ser Glu Ala Lys Ile Gln Asp Gly Thr Leu Val Ile Asn Trp Asn Pro  
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 Thr Gly Tyr Arg Leu Asp Pro Gln Lys Ala Gly Ala Leu Val Phe Asn  
                   1205                  1210                  1215  
 Ala Leu Trp Glu Glu Gly Ala Val Leu Ser Ala Leu Lys Asn Ala Arg  
                   1220                  1225                  1230  
 Phe Ala His Asn Leu Thr Ala Gln Arg Met Glu Phe Asp Tyr Ser Thr  
                   1235                  1240                  1245  
 Asn Val Trp Gly Phe Ala Phe Gly Gly Phe Arg Thr Leu Ser Ala Glu  
                   1250                  1255                  1260  
 Asn Leu Val Ala Ile Asp Gly Tyr Lys Gly Ala Tyr Gly Gly Ala Ser  
                   1265                  1270                  1275                  1280  
 Ala Gly Val Asp Ile Gln Leu Met Glu Asp Phe Val Leu Gly Val Ser  
                   1285                  1290                  1295  
 Gly Ala Ala Phe Leu Gly Lys Met Asp Ser Gln Lys Phe Asp Ala Glu  
                   1300                  1305                  1310  
 Val Ser Arg Lys Gly Val Val Gly Ser Val Tyr Thr Gly Phe Leu Ala  
                   1315                  1320                  1325  
 Gly Ser Trp Phe Phe Lys Gly Gln Tyr Ser Leu Gly Glu Thr Gln Asn  
                   1330                  1335                  1340  
 Asp Met Lys Thr Arg Tyr Gly Val Leu Gly Glu Ser Ser Ala Ser Trp  
                   1345                  1350                  1355                  1360  
 Thr Ser Arg Gly Val Leu Ala Asp Ala Leu Val Glu Tyr Arg Ser Leu  
                   1365                  1370                  1375  
 Val Gly Pro Val Arg Pro Thr Phe Tyr Ala Leu His Phe Asn Pro Tyr  
                   1380                  1385                  1390  
 Val Glu Val Ser Tyr Ala Ser Met Lys Phe Pro Gly Phe Thr Glu Gln  
                   1395                  1400                  1405  
 Gly Arg Glu Ala Arg Ser Phe Glu Asp Ala Ser Leu Thr Asn Ile Thr  
                   1410                  1415                  1420  
 Ile Pro Leu Gly Met Lys Phe Glu Leu Ala Phe Ile Lys Gly Gln Phe  
                   1425                  1430                  1435                  1440



Ser Glu Val Asn Ser Leu Gly Ile Ser Tyr Ala Trp Glu Ala Tyr Arg  
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 Lys Val Glu Gly Gly Ala Val Gln Leu Leu Glu Ala Gly Phe Asp Trp  
 1460 1465 1470  
 Glu Gly Ala Pro Met Asp Leu Pro Arg Gln Glu Leu Arg Val Ala Leu  
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 Glu Asn Asn Thr Glu Trp Ser Ser Tyr Phe Ser Thr Val Leu Gly Leu  
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 <212> PRT  
 <213> Chlamydia

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 Asp Cys Asn Val Ser Lys Val Gly Tyr Ser Thr Ser Gln Ala Phe Thr  
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 Asp Met Met Leu Ala Asp Asn Thr Glu Tyr Arg Ala Ala Asp Ser Val  
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 Ser Phe Tyr Asp Phe Ser Thr Ser Ser Gly Leu Pro Arg Lys His Leu  
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 Ser Ser Ser Ser Glu Ala Ser Pro Thr Thr Glu Gly Val Ser Ser Ser  
 85 90 95  
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 Gly Glu Thr Asp Lys Lys Thr Glu Glu Glu Leu Asp Asn Gly Gly Ile  
 115 120 125  
 Ile Tyr Ala Arg Glu Lys Leu Thr Ile Ser Glu Ser Gln Asp Ser Leu  
 130 135 140  
 Ser Asn Pro Ser Ile Glu Leu His Asp Asn Ser Phe Phe Phe Gly Glu  
 145 150 155 160  
 Gly Glu Val Ile Phe Asp His Arg Val Ala Leu Lys Asn Gly Gly Ala  
 165 170 175  
 Ile Tyr Gly Glu Lys Glu Val Val Phe Glu Asn Ile Lys Ser Leu Leu  
 180 185 190  
 Val Glu Val Asn Ile Ser Val Glu Lys Gly Gly Ser Val Tyr Ala Lys  
 195 200 205  
 Glu Arg Val Ser Leu Glu Asn Val Thr Glu Ala Thr Phe Ser Ser Asn  
 210 215 220  
 Gly Gly Glu Gln Gly Gly Gly Gly Ile Tyr Ser Glu Gln Asp Met Leu  
 225 230 235 240  
 Ile Ser Asp Cys Asn Asn Val His Phe Gln Gly Asn Ala Ala Gly Ala  
 245 250 255  
 Thr Ala Val Lys Gln Cys Leu Asp Glu Glu Met Ile Val Leu Leu Thr  
 260 265 270  
 Glu Cys Val Asp Ser Leu Ser Glu Asp Thr Leu Asp Ser Thr Pro Glu  
 275 280 285  
 Thr Glu Gln Thr Lys Ser Asn Gly Asn Gln Asp Gly Ser Ser Glu Thr  
 290 295 300  
 Lys Asp Thr Gln Val Ser Glu Ser Pro Glu Ser Thr Pro Ser Pro Asp

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305          310          315          320
Asp Val Leu Gly Lys Gly Gly Gly Ile Tyr Thr Glu Lys Ser Leu Thr
          325          330          335
Ile Thr Gly Ile Thr Gly Thr Ile Asp Phe Val Ser Asn Ile Ala Thr
          340          345          350
Asp Ser Gly Ala Gly Val Phe Thr Lys Glu Asn Leu Ser Cys Thr Asn
          355          360          365
Thr Asn Ser Leu Gln Phe Leu Lys Asn Ser Ala Gly Gln His Gly Gly
          370          375          380
Gly Ala Tyr Val Thr Gln Thr Met Ser Val Thr Asn Thr Thr Ser Glu
385          390          395          400
Ser Ile Thr Thr Pro Pro Leu Val Gly Glu Val Ile Phe Ser Glu Asn
          405          410          415
Thr Ala Lys Gly His Gly Gly Gly Ile Cys Thr Asn Lys Leu Ser Leu
          420          425          430
Ser Asn Leu Lys Thr Val Thr Leu Thr Lys Asn Ser Ala Lys Glu Ser
          435          440          445
Gly Gly Ala Ile Phe Thr Asp Leu Ala Ser Ile Pro Thr Thr Asp Thr
          450          455          460
Pro Glu Ser Ser Thr Pro Ser Ser Ser Ser Pro Ala Ser Thr Pro Glu
465          470          475          480
Val Val Ala Ser Ala Lys Ile Asn Arg Phe Phe Ala Ser Thr Ala Glu
          485          490          495
Pro Ala Ala Pro Ser Leu Thr Glu Ala Glu Ser Asp Gln Thr Asp Gln
          500          505          510
Thr Glu Thr Ser Asp Thr Asn Ser Asp Ile Asp Val Ser Ile Glu Asn
          515          520          525
Ile Leu Asn Val Ala Ile Asn Gln Asn Thr Ser Ala Lys Lys Gly Gly
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Ala Ile Tyr Gly Lys Lys Ala Lys Leu Ser Arg Ile Asn Asn Leu Glu
545          550          555          560
Leu Ser Gly Asn Ser Ser Gln Asp Val Gly Gly Gly Leu Cys Leu Thr
          565          570          575
Glu Ser Val Glu Phe Asp Ala Ile Gly Ser Leu Leu Ser His Tyr Asn
          580          585          590
Ser Ala Ala Lys Glu Gly Gly Val Ile His Ser Lys Thr Val Thr Leu
          595          600          605
Ser Asn Leu Lys Ser Thr Phe Thr Phe Ala Asp Asn Thr Val Lys Ala
          610          615          620
Ile Val Glu Ser Thr Pro Glu Ala Pro Glu Glu Ile Pro Pro Val Glu
625          630          635          640
Gly Glu Glu Ser Thr Ala Thr Glu Asn Pro Asn Ser Asn Thr Glu Gly
          645          650          655
Ser Ser Ala Asn Thr Asn Leu Glu Gly Ser Gln Gly Asp Thr Ala Asp
          660          665          670
Thr Gly Thr Gly Val Val Asn Asn Glu Ser Gln Asp Thr Ser Asp Thr
          675          680          685
Gly Asn Ala Glu Ser Gly Glu Gln Leu Gln Asp Ser Thr Gln Ser Asn
          690          695          700
Glu Glu Asn Thr Leu Pro Asn Ser Ser Ile Asp Gln Ser Asn Glu Asn
705          710          715          720
Thr Asp Glu Ser Ser Asp Ser His Thr Glu Glu Ile Thr Asp Glu Ser
          725          730          735
Val Ser Ser Ser Ser Lys Ser Gly Ser Ser Thr Pro Gln Asp Gly Gly
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Ala Ala Ser Ser Gly Ala Pro Ser Gly Asp Gln Ser Ile Ser Ala Asn
          755          760          765
Ala Cys Leu Ala Lys Ser Tyr Ala Ala Ser Thr Asp Ser Ser Pro Val

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770	775	780
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785	790	795
Ser Ser Ser Ser Gly	Asp Ser Ala Gly Asp	Ser Glu Gly Pro Thr Glu
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Pro Glu Ala Gly Ser Thr Thr Glu Thr Pro Thr Leu Ile Gly Gly Gly		
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Ala Ile Tyr Gly Glu Thr Val Lys Ile Glu Asn Phe Ser Gly Gln Gly		
835	840	845
Ile Phe Ser Gly Asn Lys Ala Ile Asp Asn Thr Thr Glu Gly Ser Ser		
850	855	860
Ser Lys Ser Asn Val Leu Gly Gly Ala Val Tyr Ala Lys Thr Leu Phe		
865	870	875
Asn Leu Asp Ser Gly Ser Ser Arg Arg Thr Val Thr Phe Ser Gly Asn		
885	890	895
Thr Val Ser Ser Gln Ser Thr Thr Gly Gln Val Ala Gly Gly Ala Ile		
900	905	910
Tyr Ser Pro Thr Val Thr Ile Ala Thr Pro Val Val Phe Ser Lys Asn		
915	920	925
Ser Ala Thr Asn Asn Ala Asn Asn Ala Thr Asp Thr Gln Arg Lys Asp		
930	935	940
Thr Phe Gly Gly Ala Ile Gly Ala Thr Ser Ala Val Ser Leu Ser Gly		
945	950	955
Gly Ala His Phe Leu Glu Asn Val Ala Asp Leu Gly Ser Ala Ile Gly		
965	970	975
Leu Val Pro Asp Thr Gln Asn Thr Glu Thr Val Lys Leu Glu Ser Gly		
980	985	990
Ser Tyr Tyr Phe Glu Lys Asn Lys Ala Leu Lys Arg Ala Thr Ile Tyr		
995	1000	1005
Ala Pro Val Val Ser Ile Lys Ala Tyr Thr Ala Thr Phe Asn Gln Asn		
1010	1015	1020
Arg Ser Leu Glu Glu Gly Ser Ala Ile Tyr Phe Thr Lys Glu Ala Ser		
1025	1030	1035
Ile Glu Ser Leu Gly Ser Val Leu Phe Thr Gly Asn Leu Val Thr Pro		
1045	1050	1055
Thr Leu Ser Thr Thr Thr Glu Gly Thr Pro Ala Thr Thr Ser Gly Asp		
1060	1065	1070
Val Thr Lys Tyr Gly Ala Ala Ile Phe Gly Gln Ile Ala Ser Ser Asn		
1075	1080	1085
Gly Ser Gln Thr Asp Asn Leu Pro Leu Lys Leu Ile Ala Ser Gly Gly		
1090	1095	1100
Asn Ile Cys Phe Arg Asn Asn Glu Tyr Arg Pro Thr Ser Ser Asp Thr		
1105	1110	1115
Gly Thr Ser Thr Phe Cys Ser Ile Ala Gly Asp Val Lys Leu Thr Met		
1125	1130	1135
Gln Ala Ala Lys Gly Lys Thr Ile Ser Phe Phe Asp Ala Ile Arg Thr		
1140	1145	1150
Ser Thr Lys Lys Thr Gly Thr Gln Ala Thr Ala Tyr Asp Thr Leu Asp		
1155	1160	1165
Ile Asn Lys Ser Glu Asp Ser Glu Thr Val Asn Ser Ala Phe Thr Gly		
1170	1175	1180
Thr Ile Leu Phe Ser Ser Glu Leu His Glu Asn Lys Ser Tyr Ile Pro		
1185	1190	1195
Gln Asn Val Val Leu His Ser Gly Ser Leu Val Leu Lys Pro Asn Thr		
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Glu Leu His Val Ile Ser Phe Glu Gln Lys Glu Gly Ser Ser Leu Val		
1220	1225	1230
Met Thr Pro Gly Ser Val Leu Ser Asn Gln Thr Val Ala Asp Gly Ala		

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Leu Val Ile Asn Asn Met Thr Ile Asp Leu Ser Ser Val Glu Lys Asn		
1250	1255	1260
Gly Ile Ala Glu Gly Asn Ile Phe Thr Pro Pro Glu Leu Arg Ile Ile		
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Asp Thr Thr Thr Ser Gly Ser Gly Gly Thr Pro Ser Thr Asp Ser Glu		1280
	1285	1290
Ser Asn Gln Asn Ser Asp Asp Thr Lys Glu Gln Asn Asn Asn Asp Ala		1295
	1300	1305
Ser Asn Gln Gly Glu Ser Ala Asn Gly Ser Ser Ser Pro Ala Val Ala		1310
	1315	1320
Ala Ala His Thr Ser Arg Thr Arg Asn Phe Ala Ala Ala Ala Thr Ala		1325
	1330	1335
Thr Pro Thr Thr Thr Pro Thr Ala Thr Thr Thr Thr Ser Asn Gln Val		1340
1345	1350	1355
Ile Leu Gly Gly Glu Ile Lys Leu Ile Asp Pro Asn Gly Thr Phe Phe		1360
	1365	1370
Gln Asn Pro Ala Leu Arg Ser Asp Gln Gln Ile Ser Leu Leu Val Leu		1375
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Pro Thr Asp Ser Ser Lys Met Gln Ala Gln Lys Ile Val Leu Thr Gly		1390
	1395	1400
Asp Ile Ala Pro Gln Lys Gly Tyr Thr Gly Thr Leu Thr Leu Asp Pro		1405
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Asp Gln Leu Gln Asn Gly Thr Ile Ser Ala Leu Trp Lys Phe Asp Ser		1420
1425	1430	1435
Tyr Arg Gln Trp Ala Tyr Val Pro Arg Asp Asn His Phe Tyr Ala Asn		1440
	1445	1450
Ser Ile Leu Gly Ser Gln Met Ser Met Val Thr Val Lys Gln Gly Leu		1455
	1460	1465
Leu Asn Asp Lys Met Asn Leu Ala Arg Phe Asp Glu Val Ser Tyr Asn		1470
	1475	1480
Asn Leu Trp Ile Ser Gly Leu Gly Thr Met Leu Ser Gln Val Gly Thr		1485
	1490	1495
Pro Thr Ser Glu Glu Phe Thr Tyr Tyr Ser Arg Gly Ala Ser Val Ala		1500
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Leu Asp Ala Lys Pro Ala His Asp Val Ile Val Gly Ala Ala Phe Ser		1520
	1525	1530
Lys Met Ile Gly Lys Thr Lys Ser Leu Lys Arg Glu Asn Asn Tyr Thr		1535
	1540	1545
His Lys Gly Ser Glu Tyr Ser Tyr Gln Ala Ser Val Tyr Gly Gly Lys		1550
	1555	1560
Pro Phe His Phe Val Ile Asn Lys Lys Thr Glu Lys Ser Leu Pro Leu		1565
	1570	1575
Leu Leu Gln Gly Val Ile Ser Tyr Gly Tyr Ile Lys His Asp Thr Val		1580
1585	1590	1595
Thr His Tyr Pro Thr Ile Arg Glu Arg Asn Gln Gly Glu Trp Glu Asp		1600
	1605	1610
Leu Gly Trp Leu Thr Ala Leu Arg Val Ser Ser Val Leu Arg Thr Pro		1615
	1620	1625
Ala Gln Gly Asp Thr Lys Arg Ile Thr Val Tyr Gly Glu Leu Glu Tyr		1630
	1635	1640
Ser Ser Ile Arg Gln Lys Gln Phe Thr Glu Thr Glu Tyr Asp Pro Arg		1645
	1650	1655
Tyr Phe Asp Asn Cys Thr Tyr Arg Asn Leu Ala Ile Pro Met Gly Leu		1660
1665	1670	1675
Ala Phe Glu Gly Glu Leu Ser Gly Asn Asp Ile Leu Met Tyr Asn Arg		1680
	1685	1690
Phe Ser Val Ala Tyr Met Pro Ser Ile Tyr Arg Asn Ser Pro Thr Cys		1695

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Lys	Tyr	Gln	Val	Leu	Ser	Ser	Gly	Glu	Gly	Gly	Glu	Ile	Ile	Cys	Gly
	1715						1720					1725			
Val	Pro	Thr	Arg	Asn	Ser	Ala	Arg	Gly	Glu	Tyr	Ser	Thr	Gln	Leu	Tyr
	1730						1735					1740			
Pro	Gly	Pro	Leu	Trp	Thr	Leu	Tyr	Gly	Ser	Tyr	Thr	Ile	Glu	Ala	Asp
	1745						1750					1755			1760
Ala	His	Thr	Leu	Ala	His	Met	Met	Asn	Cys	Gly	Ala	Arg	Met	Thr	Phe
				1765				1770						1775	

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 <212> PRT  
 <213> Chlamydia

<400> 180

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Val	Ser	Gly	Phe	Cys	Phe	Pro	Glu	Pro	Lys	Glu	Leu	Asn	Phe	Ser	Arg
			20					25				30			
Val	Glu	Thr	Ser	Ser	Ser	Thr	Thr	Phe	Thr	Glu	Thr	Ile	Gly	Glu	Ala
		35					40					45			
Gly	Ala	Glu	Tyr	Ile	Val	Ser	Gly	Asn	Ala	Ser	Phe	Thr	Lys	Phe	Thr
	50					55				60					
Asn	Ile	Pro	Thr	Thr	Asp	Thr	Thr	Thr	Pro	Thr	Asn	Ser	Asn	Ser	Ser
65					70					75					80
Ser	Ser	Ser	Gly	Glu	Thr	Ala	Ser	Val	Ser	Glu	Asp	Ser	Asp	Ser	Thr
				85					90					95	
Thr	Thr	Thr	Pro	Asp	Pro	Lys	Gly	Gly	Gly	Ala	Phe	Tyr	Asn	Ala	His
			100				105						110		
Ser	Gly	Val	Leu	Ser	Phe	Met	Thr	Arg	Ser	Gly	Thr	Glu	Gly	Ser	Leu
		115					120					125			
Thr	Leu	Ser	Glu	Ile	Lys	Met	Thr	Gly	Glu	Gly	Gly	Ala	Ile	Phe	Ser
	130					135					140				
Gln	Gly	Glu	Leu	Leu	Phe	Thr	Asp	Leu	Thr	Ser	Leu	Thr	Ile	Gln	Asn
145					150					155					160
Asn	Leu	Ser	Gln	Leu	Ser	Gly	Gly	Ala	Ile	Phe	Gly	Gly	Ser	Thr	Ile
			165					170					175		
Ser	Leu	Ser	Gly	Ile	Thr	Lys	Ala	Thr	Phe	Ser	Cys	Asn	Ser	Ala	Glu
		180					185					190			
Val	Pro	Ala	Pro	Val	Lys	Lys	Pro	Thr	Glu	Pro	Lys	Ala	Gln	Thr	Ala
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Ser	Glu	Thr	Ser	Gly	Ser	Ser	Ser	Ser	Ser	Gly	Asn	Asp	Ser	Val	Ser
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Ser	Pro	Ser	Ser	Ser	Arg	Ala	Glu	Pro	Ala	Ala	Ala	Asn	Leu	Gln	Ser
225					230					235					240
His	Phe	Ile	Cys	Ala	Thr	Ala	Thr	Pro	Ala	Ala	Gln	Thr	Asp	Thr	Glu
			245						250					255	
Thr	Ser	Thr	Pro	Ser	His	Lys	Pro	Gly	Ser	Gly	Gly	Ala	Ile	Tyr	Ala
	260						265					270			
Lys	Gly	Asp	Leu	Thr	Ile	Ala	Asp	Ser	Gln	Glu	Val	Leu	Phe	Ser	Ile
	275					280					285				
Asn	Lys	Ala	Thr	Lys	Asp	Gly	Gly	Ala	Ile	Phe	Ala	Glu	Lys	Asp	Val
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Ser	Phe	Glu	Asn	Ile	Thr	Ser	Leu	Lys	Val	Gln	Thr	Asn	Gly	Ala	Glu
305					310					315					320
Glu	Lys	Gly	Gly	Ala	Ile	Tyr	Ala	Lys	Gly	Asp	Leu	Ser	Ile	Gln	Ser
				325					330					335	



Ser Thr Gly Val Ala Thr Thr Ala Ser Ala Pro Ala Ala Ala Ala Ala  
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 Ser Leu Gln Ala Ala Ala Ala Ala Pro Ser Ser Pro Ala Thr Pro  
 820 825 830  
 Thr Tyr Ser Gly Val Val Gly Gly Ala Ile Tyr Gly Glu Lys Val Thr  
 835 840 845  
 Phe Ser Gln Cys Ser Gly Thr Cys Gln Phe Ser Gly Asn Gln Ala Ile  
 850 855 860  
 Asp Asn Asn Pro Ser Gln Ser Ser Leu Asn Val Gln Gly Gly Ala Ile  
 865 870 875 880  
 Tyr Ala Lys Thr Ser Leu Ser Ile Gly Ser Ser Asp Ala Gly Thr Ser  
 885 890 895  
 Tyr Ile Phe Ser Gly Asn Ser Val Ser Thr Gly Lys Ser Gln Thr Thr  
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 Gly Gln Ile Ala Gly Gly Ala Ile Tyr Ser Pro Thr Val Thr Leu Asn  
 915 920 925  
 Cys Pro Ala Thr Phe Ser Asn Asn Thr Ala Ser Ile Ala Thr Pro Lys  
 930 935 940  
 Thr Ser Ser Glu Asp Gly Ser Ser Gly Asn Ser Ile Lys Asp Thr Ile  
 945 950 955 960  
 Gly Gly Ala Ile Ala Gly Thr Ala Ile Thr Leu Ser Gly Val Ser Arg  
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 Phe Ser Gly Asn Thr Ala Asp Leu Gly Ala Ala Ile Gly Thr Leu Ala  
 980 985 990  
 Asn Ala Asn Thr Pro Ser Ala Thr Ser Gly Ser Gln Asn Ser Ile Thr  
 995 1000 1005  
 Glu Lys Ile Thr Leu Glu Asn Gly Ser Phe Ile Phe Glu Arg Asn Gln  
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 Ala Asn Lys Arg Gly Ala Ile Tyr Ser Pro Ser Val Ser Ile Lys Gly  
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 Asn Asn Ile Thr Phe Asn Gln Asn Thr Ser Thr His Asp Gly Ser Ala  
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 Ile Tyr Phe Thr Lys Asp Ala Thr Ile Glu Ser Leu Gly Ser Val Leu  
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 Phe Thr Gly Asn Asn Val Thr Ala Thr Gln Ala Ser Ser Ala Thr Ser  
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 Gly Gln Asn Thr Asn Thr Ala Asn Tyr Gly Ala Ala Ile Phe Gly Asp  
 1090 1095 1100  
 Pro Gly Thr Thr Gln Ser Ser Gln Thr Asp Ala Ile Leu Thr Leu Leu  
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 Ala Ser Ser Gly Asn Ile Thr Phe Ser Asn Asn Ser Leu Gln Asn Asn  
 1125 1130 1135  
 Gln Gly Asp Thr Pro Ala Ser Lys Phe Cys Ser Ile Ala Gly Tyr Val  
 1140 1145 1150  
 Lys Leu Ser Leu Gln Ala Ala Lys Gly Lys Thr Ile Ser Phe Phe Asp  
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 Cys Val His Thr Ser Thr Lys Lys Thr Gly Ser Thr Gln Asn Val Tyr  
 1170 1175 1180  
 Glu Thr Leu Asp Ile Asn Lys Glu Glu Asn Ser Asn Pro Tyr Thr Gly  
 1185 1190 1195 1200  
 Thr Ile Val Phe Ser Ser Glu Leu His Glu Asn Lys Ser Tyr Ile Pro  
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 Gln Asn Ala Ile Leu His Asn Gly Thr Leu Val Leu Lys Glu Lys Thr  
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 Glu Leu His Val Val Ser Phe Glu Gln Lys Glu Gly Ser Lys Leu Ile  
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 Met Glu Pro Gly Ala Val Leu Ser Asn Gln Asn Ile Ala Asn Gly Ala  
 1250 1255 1260

Leu Ala Ile Asn Gly Leu Thr Ile Asp Leu Ser Ser Met Gly Thr Pro  
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 Gln Ala Gly Glu Ile Phe Ser Pro Pro Glu Leu Arg Ile Val Ala Thr  
 1285 1290 1295  
 Thr Ser Ser Ala Ser Gly Gly Ser Gly Val Ser Ser Ser Ile Pro Thr  
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 Asn Pro Lys Arg Ile Ser Ala Ala Val Pro Ser Gly Ser Ala Ala Thr  
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 Thr Pro Thr Met Ser Glu Asn Lys Val Phe Leu Thr Gly Asp Leu Thr  
 1330 1335 1340  
 Leu Ile Asp Pro Asn Gly Asn Phe Tyr Gln Asn Pro Met Leu Gly Ser  
 1345 1350 1355 1360  
 Asp Leu Asp Val Pro Leu Ile Lys Leu Pro Thr Asn Thr Ser Asp Val  
 1365 1370 1375  
 Gln Val Tyr Asp Leu Thr Leu Ser Gly Asp Leu Phe Pro Gln Lys Gly  
 1380 1385 1390  
 Tyr Met Gly Thr Trp Thr Leu Asp Ser Asn Pro Gln Thr Gly Lys Leu  
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 Gln Ala Arg Trp Thr Phe Asp Thr Tyr Arg Arg Trp Val Tyr Ile Pro  
 1410 1415 1420  
 Arg Asp Asn His Phe Tyr Ala Asn Ser Ile Leu Gly Ser Gln Asn Ser  
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 Arg Phe Asp Asp Ile Ala Tyr Asn Asn Phe Trp Val Ser Gly Val Gly  
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 1475 1480 1485  
 Tyr Ser Arg Gly Thr Ser Val Ala Ile Asp Ala Lys Pro Arg Gln Asp  
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 Phe Ile Leu Gly Ala Ala Phe Ser Lys Ile Val Gly Lys Thr Lys Ala  
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 Ile Lys Lys Met His Asn Tyr Phe His Lys Gly Ser Glu Tyr Ser Tyr  
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 Gln Ala Ser Val Tyr Gly Gly Lys Phe Leu Tyr Phe Leu Leu Asn Lys  
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 Gln His Gly Trp Ala Leu Pro Phe Leu Ile Gln Gly Val Val Ser Tyr  
 1555 1560 1565  
 Gly His Ile Lys His Asp Thr Thr Thr Leu Tyr Pro Ser Ile His Glu  
 1570 1575 1580  
 Arg Asn Lys Gly Asp Trp Glu Asp Leu Gly Trp Leu Ala Asp Leu Arg  
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 Ile Ser Met Asp Leu Lys Glu Pro Ser Lys Asp Ser Ser Lys Arg Ile  
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 Thr Val Tyr Gly Glu Leu Glu Tyr Ser Ser Ile Arg Gln Lys Gln Phe  
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 Thr Glu Ile Asp Tyr Asp Pro Arg His Phe Asp Asp Cys Ala Tyr Arg  
 1635 1640 1645  
 Asn Leu Ser Leu Pro Val Gly Cys Ala Val Glu Gly Ala Ile Met Asn  
 1650 1655 1660  
 Cys Asn Ile Leu Met Tyr Asn Lys Leu Ala Leu Ala Tyr Met Pro Ser  
 1665 1670 1675 1680  
 Ile Tyr Arg Asn Asn Pro Val Cys Lys Tyr Arg Val Leu Ser Ser Asn  
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 Glu Ala Gly Gln Val Ile Cys Gly Val Pro Thr Arg Thr Ser Ala Arg  
 1700 1705 1710  
 Ala Glu Tyr Ser Thr Gln Leu Tyr Leu Gly Pro Phe Trp Thr Leu Tyr  
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Gly Asn Tyr Thr Ile Asp Val Gly Met Tyr Thr Leu Ser Gln Met Thr  
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<400> 181  
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 agcctctttc ctgctctttg tgctcatgca tcacaagacg atcctttgta tgtacttgga 180  
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 aatggtagca tgagtttctg tcgaaatcat gctgaaggct ctggaggagc catctctgcg 420  
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 <211> 3021

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 182

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&lt;211&gt; 2934

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 183

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&lt;211&gt; 2547

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 184

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&lt;211&gt; 2337

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 185

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&lt;210&gt; 186

&lt;211&gt; 2847

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 186

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&lt;210&gt; 187

&lt;211&gt; 2466

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 187

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&lt;210&gt; 188

&lt;211&gt; 1578

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 188

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&lt;210&gt; 189

&lt;211&gt; 866

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; VARIANT

&lt;222&gt; (1)...(866)

&lt;223&gt; Xaa = Any Amino Acid

&lt;400&gt; 189

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           35           40           45
His Ala Ser Gln Asp Asp Pro Leu Tyr Val Leu Gly Asn Ser Tyr Cys
           50           55           60
Trp Phe Val Ser Lys Leu His Ile Thr Asp Pro Lys Glu Ala Leu Phe
65           70           75           80
Lys Glu Lys Gly Asp Leu Ser Ile Gln Asn Phe Arg Phe Leu Ser Phe
           85           90           95
Thr Asp Cys Ser Ser Lys Glu Ser Ser Pro Ser Ile Ile His Gln Lys
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Asn Gly Gln Leu Ser Leu Arg Asn Asn Gly Ser Met Ser Phe Cys Arg
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Asn His Ala Glu Gly Ser Gly Gly Ala Ile Ser Ala Asp Ala Phe Ser
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305          310          315          320
Leu Glu Lys Asp Ala Ile Leu Ser Ser Leu Glu Ala Arg Asn Gly Asp
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Ile Leu Phe Phe Asp Pro Ile Val Gln Glu Ser Ser Ser Lys Glu Ser
           340          345          350
Pro Leu Pro Ser Ser Leu Gln Ala Ser Val Thr Ser Pro Thr Pro Ala
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Phe Ser Ser Glu Arg Leu Ser Glu Glu Glu Lys Thr Pro Asp Asn Leu

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Gln	Ala	Leu	Leu	Ile	Met	Glu	Ala	Gly	Thr	Ser	Leu	Lys	Thr	Ser
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Ala	Thr	Ser	Leu	Met	Lys	Ile	Ser	Ala	Gln	Ala	Cys	Tyr	Asn	Glu
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Pro	Ile	Val	Ser	Asn	Gly	Ser	Gly	Leu	Phe	Ser	Ser	Phe	Ser	Ile
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Ser	Gly	Glu	Ile	Arg	Ser	Phe	Ser	Ala	Ser	Ser	Phe	Arg	Asn	Ile
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Tyr	Tyr	Tyr	Phe	Leu	Gly	Ala	Tyr	Ile	Gln	Asp	Leu	Lys	Arg	Asp
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Glu	Ser	Gly	Pro	Val	Val	Leu	Leu	Lys	Asn	Ala	Val	Ser	Trp	Asp
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Pro	Met	Ala	Asn	Leu	Asp	Ser	Arg	Ala	Tyr	Met	Phe	Arg	Leu	Thr
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Gln	Arg	Ala	Leu	His	Arg	Leu	Gln	Thr	Leu	Leu	Asn	Val	Ser	Cys
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Arg Phe  
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855

860

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<213> Chlamydia

<400> 190

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Asp	Asn	Ser	Ile	Ala	Ala	Leu	Pro	Leu	Ser	Cys	Phe	Gly	Asn	Leu	Leu
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Gly	Ser	Phe	Thr	Val	Leu	Gly	Arg	Gly	His	Ser	Leu	Thr	Phe	Glu	Asn
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Gly	Leu	Phe	Thr	Ile	Glu	Gly	Phe	Lys	Glu	Leu	Ser	Phe	Ser	Asn	Cys
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Lys	Thr	Asp	Leu	Leu	Leu	Leu	Asn	Asn	Glu	Lys	Phe	Ser	Phe	Tyr	Ser
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Ala	Asp	Gly	Gly	Ala	Cys	Gln	Val	Val	Thr	Ser	Phe	Ser	Ala	Met	Ala
	210					215					220				
Asn	Glu	Ala	Pro	Ile	Ala	Phe	Val	Ala	Asn	Val	Ala	Gly	Val	Arg	Gly
225					230				235						240
Gly	Gly	Ile	Ala	Ala	Val	Gln	Asp	Gly	Gln	Gln	Gly	Val	Ser	Ser	Ser
			245						250					255	
Thr	Ser	Thr	Glu	Asp	Pro	Val	Val	Ser	Phe	Ser	Arg	Asn	Thr	Ala	Val
		260						265					270		
Glu	Phe	Asp	Gly	Asn	Val	Ala	Arg	Val	Gly	Gly	Gly	Ile	Tyr	Ser	Tyr
		275					280					285			
Gly	Asn	Val	Ala	Phe	Leu	Asn	Asn	Gly	Lys	Thr	Leu	Phe	Leu	Asn	Asn
	290					295					300				
Val	Ala	Ser	Pro	Val	Tyr	Ile	Ala	Ala	Lys	Gln	Pro	Thr	Ser	Gly	Gln
305					310					315					320
Ala	Ser	Asn	Thr	Ser	Asn	Asn	Tyr	Gly	Asp	Gly	Gly	Ala	Ile	Phe	Cys
			325						330					335	
Lys	Asn	Gly	Ala	Gln	Ala	Gly	Ser	Asn	Asn	Ser	Gly	Ser	Val	Ser	Phe
		340						345					350		
Asp	Gly	Glu	Gly	Val	Val	Phe	Phe	Ser	Ser	Asn	Val	Ala	Ala	Gly	Lys
		355					360					365			
Gly	Gly	Ala	Ile	Tyr	Ala	Lys	Lys	Leu	Ser	Val	Ala	Asn	Cys	Gly	Pro
	370					375					380				

Val	Gln	Phe	Leu	Arg	Asn	Ile	Ala	Asn	Asp	Gly	Gly	Ala	Ile	Tyr	Leu	385	390	395	400
Gly	Glu	Ser	Gly	Glu	Leu	Ser	Leu	Ser	Ala	Asp	Tyr	Gly	Asp	Ile	Ile		405	410	415
Phe	Asp	Gly	Asn	Leu	Lys	Arg	Thr	Ala	Lys	Glu	Asn	Ala	Ala	Asp	Val	420	425	430	
Asn	Gly	Val	Thr	Val	Ser	Ser	Gln	Ala	Ile	Ser	Met	Gly	Ser	Gly	Gly	435	440	445	
Lys	Ile	Thr	Thr	Leu	Arg	Ala	Lys	Ala	Gly	His	Gln	Ile	Leu	Phe	Asn	450	455	460	
Asp	Pro	Ile	Glu	Met	Ala	Asn	Gly	Asn	Asn	Gln	Pro	Ala	Gln	Ser	Ser	465	470	475	480
Lys	Leu	Leu	Lys	Ile	Asn	Asp	Gly	Glu	Gly	Tyr	Thr	Gly	Asp	Ile	Val	485	490	495	
Phe	Ala	Asn	Gly	Ser	Ser	Thr	Leu	Tyr	Gln	Asn	Val	Thr	Ile	Glu	Gln	500	505	510	
Gly	Arg	Ile	Val	Leu	Arg	Glu	Lys	Ala	Lys	Leu	Ser	Val	Asn	Ser	Leu	515	520	525	
Ser	Gln	Thr	Gly	Gly	Ser	Leu	Tyr	Met	Glu	Ala	Gly	Ser	Thr	Leu	Asp	530	535	540	
Phe	Val	Thr	Pro	Gln	Pro	Pro	Gln	Gln	Pro	Pro	Ala	Ala	Asn	Gln	Leu	545	550	555	560
Ile	Thr	Leu	Ser	Asn	Leu	His	Leu	Ser	Leu	Ser	Ser	Leu	Leu	Ala	Asn	565	570	575	
Asn	Ala	Val	Thr	Asn	Pro	Pro	Thr	Asn	Pro	Pro	Ala	Gln	Asp	Ser	His	580	585	590	
Pro	Ala	Val	Ile	Gly	Ser	Thr	Thr	Ala	Gly	Ser	Val	Thr	Ile	Ser	Gly	595	600	605	
Pro	Ile	Phe	Phe	Glu	Asp	Leu	Asp	Asp	Thr	Ala	Tyr	Asp	Arg	Tyr	Asp	610	615	620	
Trp	Leu	Gly	Ser	Asn	Gln	Lys	Ile	Asn	Val	Leu	Lys	Leu	Gln	Leu	Gly	625	630	635	640
Thr	Lys	Pro	Pro	Ala	Asn	Ala	Pro	Ser	Asp	Leu	Thr	Leu	Gly	Asn	Glu	645	650	655	
Met	Pro	Lys	Tyr	Gly	Tyr	Gln	Gly	Ser	Trp	Lys	Leu	Ala	Trp	Asp	Pro	660	665	670	
Asn	Thr	Ala	Asn	Asn	Gly	Pro	Tyr	Thr	Leu	Lys	Ala	Thr	Trp	Thr	Lys	675	680	685	
Thr	Gly	Tyr	Asn	Pro	Gly	Pro	Glu	Arg	Val	Ala	Ser	Leu	Val	Pro	Asn	690	695	700	
Ser	Leu	Trp	Gly	Ser	Ile	Leu	Asp	Ile	Arg	Ser	Ala	His	Ser	Ala	Ile	705	710	715	720
Gln	Ala	Ser	Val	Asp	Gly	Arg	Ser	Tyr	Cys	Arg	Gly	Leu	Trp	Val	Ser	725	730	735	
Gly	Val	Ser	Asn	Phe	Phe	Tyr	His	Asp	Arg	Asp	Ala	Leu	Gly	Gln	Gly	740	745	750	
Tyr	Arg	Tyr	Ile	Ser	Gly	Gly	Tyr	Ser	Leu	Gly	Ala	Asn	Ser	Tyr	Phe	755	760	765	
Gly	Ser	Ser	Met	Phe	Gly	Leu	Ala	Phe	Thr	Glu	Val	Phe	Gly	Arg	Ser	770	775	780	
Lys	Asp	Tyr	Val	Val	Cys	Arg	Ser	Asn	His	His	Ala	Cys	Ile	Gly	Ser	785	790	795	800
Val	Tyr	Leu	Ser	Thr	Gln	Gln	Ala	Leu	Cys	Gly	Ser	Tyr	Leu	Phe	Gly	805	810	815	
Asp	Ala	Phe	Ile	Arg	Ala	Ser	Tyr	Gly	Phe	Gly	Asn	Gln	His	Met	Lys	820	825	830	
Thr	Ser	Tyr	Thr	Phe	Ala	Glu	Glu	Ser	Asp	Val	Arg	Trp	Asp	Asn	Asn	835	840	845	

Cys Leu Ala Gly Glu Ile Gly Ala Gly Leu Pro Ile Val Ile Thr Pro  
 850 855 860  
 Ser Lys Leu Tyr Leu Asn Glu Leu Arg Pro Phe Val Gln Ala Glu Phe  
 865 870 875 880  
 Ser Tyr Ala Asp His Glu Ser Phe Thr Glu Glu Gly Asp Gln Ala Arg  
 885 890 895  
 Ala Phe Lys Ser Gly His Leu Leu Asn Leu Ser Val Pro Val Gly Val  
 900 905 910  
 Lys Phe Asp Arg Cys Ser Ser Thr His Pro Asn Lys Tyr Ser Phe Met  
 915 920 925  
 Ala Ala Tyr Ile Cys Asp Ala Tyr Arg Thr Ile Ser Gly Thr Glu Thr  
 930 935 940  
 Thr Leu Leu Ser His Gln Glu Thr Trp Thr Thr Asp Ala Phe His Leu  
 945 950 955 960  
 Ala Arg His Gly Val Val Val Arg Gly Ser Met Tyr Ala Ser Leu Thr  
 965 970 975  
 Ser Asn Ile Glu Val Tyr Gly His Gly Arg Tyr Glu Tyr Arg Asp Ala  
 980 985 990  
 Ser Arg Gly Tyr Gly Leu Ser Ala Gly Ser Lys Val Arg Phe  
 995 1000 1005

<210> 191  
 <211> 977  
 <212> PRT  
 <213> Chlamydia

<400> 191  
 Met Ala Ser Met Thr Gly Gly Gln Gln Met Gly Arg Asp Ser Ser Leu  
 1 5 10 15  
 Val Pro Ser Ser Asp Pro His His His His His His Gly Leu Ala Arg  
 20 25 30  
 Glu Val Pro Ser Arg Ile Phe Leu Met Pro Asn Ser Val Pro Asp Pro  
 35 40 45  
 Thr Lys Glu Ser Leu Ser Asn Lys Ile Ser Leu Thr Gly Asp Thr His  
 50 55 60  
 Asn Leu Thr Asn Cys Tyr Leu Asp Asn Leu Arg Tyr Ile Leu Ala Ile  
 65 70 75 80  
 Leu Gln Lys Thr Pro Asn Glu Gly Ala Ala Val Thr Ile Thr Asp Tyr  
 85 90 95  
 Leu Ser Phe Phe Asp Thr Gln Lys Glu Gly Ile Tyr Phe Ala Lys Asn  
 100 105 110  
 Leu Thr Pro Glu Ser Gly Gly Ala Ile Gly Tyr Ala Ser Pro Asn Ser  
 115 120 125  
 Pro Thr Val Glu Ile Arg Asp Thr Ile Gly Pro Val Ile Phe Glu Asn  
 130 135 140  
 Asn Thr Cys Cys Arg Leu Phe Thr Trp Arg Asn Pro Tyr Ala Ala Asp  
 145 150 155 160  
 Lys Ile Arg Glu Gly Gly Ala Ile His Ala Gln Asn Leu Tyr Ile Asn  
 165 170 175  
 His Asn His Asp Val Val Gly Phe Met Lys Asn Phe Ser Tyr Val Gln  
 180 185 190  
 Gly Gly Ala Ile Ser Thr Ala Asn Thr Phe Val Val Ser Glu Asn Gln  
 195 200 205  
 Ser Cys Phe Leu Phe Met Asp Asn Ile Cys Ile Gln Thr Asn Thr Ala  
 210 215 220  
 Gly Lys Gly Gly Ala Ile Tyr Ala Gly Thr Ser Asn Ser Phe Glu Ser  
 225 230 235 240  
 Asn Asn Cys Asp Leu Phe Phe Ile Asn Asn Ala Cys Cys Ala Gly Gly



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705          710          715          720
Glu Asn His Pro Gly Phe His Met Arg Ser Ser Gly Tyr Ser Ala Gly
          725          730          735
Met Ile Ala Gly Gln Thr His Thr Phe Ser Leu Lys Phe Ser Gln Thr
          740          745          750
Tyr Thr Lys Leu Asn Glu Arg Tyr Ala Lys Asn Asn Val Ser Ser Lys
          755          760          765
Asn Tyr Ser Cys Gln Gly Glu Met Leu Phe Ser Leu Gln Glu Gly Phe
          770          775          780
Leu Leu Thr Lys Leu Val Gly Leu Tyr Ser Tyr Gly Asp His Asn Cys
785          790          795          800
His His Phe Tyr Thr Gln Gly Glu Asn Leu Thr Ser Gln Gly Thr Phe
          805          810          815
Arg Ser Gln Thr Met Gly Gly Ala Val Phe Phe Asp Leu Pro Met Lys
          820          825          830
Pro Phe Gly Ser Thr His Ile Leu Thr Ala Pro Phe Leu Gly Ala Leu
          835          840          845
Gly Ile Tyr Ser Ser Leu Ser His Phe Thr Glu Val Gly Ala Tyr Pro
850          855          860
Arg Ser Phe Ser Thr Lys Thr Pro Leu Ile Asn Val Leu Val Pro Ile
865          870          875          880
Gly Val Lys Gly Ser Phe Met Asn Ala Thr His Arg Pro Gln Ala Trp
          885          890          895
Thr Val Glu Leu Ala Tyr Gln Pro Val Leu Tyr Arg Gln Glu Pro Gly
          900          905          910
Ile Ala Thr Gln Leu Leu Ala Ser Lys Gly Ile Trp Phe Gly Ser Gly
          915          920          925
Ser Pro Ser Ser Arg His Ala Met Ser Tyr Lys Ile Ser Gln Gln Thr
930          935          940
Gln Pro Leu Ser Trp Leu Thr Leu His Phe Gln Tyr His Gly Phe Tyr
945          950          955          960
Ser Ser Ser Thr Phe Cys Asn Tyr Leu Asn Gly Glu Ile Ala Leu Arg
          965          970          975
Phe

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&lt;210&gt; 192

&lt;211&gt; 848

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 192

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Met Ala Ser His His His His His Gly Ala Ile Ser Cys Leu Arg
 1          5          10          15
Gly Asp Val Val Ile Ser Gly Asn Lys Gly Arg Val Glu Phe Lys Asp
          20          25          30
Asn Ile Ala Thr Arg Leu Tyr Val Glu Glu Thr Val Glu Lys Val Glu
          35          40          45
Glu Val Glu Pro Ala Pro Glu Gln Lys Asp Asn Asn Glu Leu Ser Phe
          50          55          60
Leu Gly Ser Val Glu Gln Ser Phe Ile Thr Ala Ala Asn Gln Ala Leu
65          70          75          80
Phe Ala Ser Glu Asp Gly Asp Leu Ser Pro Glu Ser Ser Ile Ser Ser
          85          90          95
Glu Glu Leu Ala Lys Arg Arg Glu Cys Ala Gly Gly Ala Ile Phe Ala
          100          105          110
Lys Arg Val Arg Ile Val Asp Asn Gln Glu Ala Val Val Phe Ser Asn
          115          120          125

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Asn Phe Ser Asp Ile Tyr Gly Gly Ala Ile Phe Thr Gly Ser Leu Arg
 130      135      140
Glu Glu Asp Lys Leu Asp Gly Gln Ile Pro Glu Val Leu Ile Ser Gly
145      150      155      160
Asn Ala Gly Asp Val Val Phe Ser Gly Asn Ser Ser Lys Arg Asp Glu
      165      170      175
His Leu Pro His Thr Gly Gly Gly Ala Ile Cys Thr Gln Asn Leu Thr
      180      185      190
Ile Ser Gln Asn Thr Gly Asn Val Leu Phe Tyr Asn Asn Val Ala Cys
      195      200      205
Ser Gly Gly Ala Val Arg Ile Glu Asp His Gly Asn Val Leu Leu Glu
      210      215      220
Ala Phe Gly Gly Asp Ile Val Phe Lys Gly Asn Ser Ser Phe Arg Ala
225      230      235      240
Gln Gly Ser Asp Ala Ile Tyr Phe Ala Gly Lys Glu Ser His Ile Thr
      245      250      255
Ala Leu Asn Ala Thr Glu Gly His Ala Ile Val Phe His Asp Ala Leu
      260      265      270
Val Phe Glu Asn Leu Lys Glu Arg Lys Ser Ala Glu Val Leu Leu Ile
      275      280      285
Asn Ser Arg Glu Asn Pro Gly Tyr Thr Gly Ser Ile Arg Phe Leu Glu
      290      295      300
Ala Glu Ser Lys Val Pro Gln Cys Ile His Val Gln Gln Gly Ser Leu
305      310      315      320
Glu Leu Leu Asn Gly Ala Thr Leu Cys Ser Tyr Gly Phe Lys Gln Asp
      325      330      335
Ala Gly Ala Lys Leu Val Leu Ala Ala Gly Ser Lys Leu Lys Ile Leu
      340      345      350
Asp Ser Gly Thr Pro Val Gln Gly His Ala Ile Ser Lys Pro Glu Ala
      355      360      365
Glu Ile Glu Ser Ser Ser Glu Pro Glu Gly Ala His Ser Leu Trp Ile
      370      375      380
Ala Lys Asn Ala Gln Thr Thr Val Pro Met Val Asp Ile His Thr Ile
385      390      395      400
Ser Val Asp Leu Ala Ser Phe Ser Ser Ser Gln Gln Glu Gly Thr Val
      405      410      415
Glu Ala Pro Gln Val Ile Val Pro Gly Gly Ser Tyr Val Arg Ser Gly
      420      425      430
Glu Leu Asn Leu Glu Leu Val Asn Thr Thr Gly Thr Gly Tyr Glu Asn
      435      440      445
His Ala Leu Leu Lys Asn Glu Ala Lys Val Pro Leu Met Ser Phe Val
      450      455      460
Ala Ser Ser Asp Glu Ala Ser Ala Glu Ile Ser Asn Leu Ser Val Ser
465      470      475      480
Asp Leu Gln Ile His Val Ala Thr Pro Glu Ile Glu Glu Asp Thr Tyr
      485      490      495
Gly His Met Gly Asp Trp Ser Glu Ala Lys Ile Gln Asp Gly Thr Leu
      500      505      510
Val Ile Asn Trp Asn Pro Thr Gly Tyr Arg Leu Asp Pro Gln Lys Ala
      515      520      525
Gly Ala Leu Val Phe Asn Ala Leu Trp Glu Glu Gly Ala Val Leu Ser
      530      535      540
Ala Leu Lys Asn Ala Arg Phe Ala His Asn Leu Thr Ala Gln Arg Met
545      550      555      560
Glu Phe Asp Tyr Ser Thr Asn Val Trp Gly Phe Ala Phe Gly Gly Phe
      565      570      575
Arg Thr Leu Ser Ala Glu Asn Leu Val Ala Ile Asp Gly Tyr Lys Gly
      580      585      590

```

Ala Tyr Gly Gly Ala Ser Ala Gly Val Asp Ile Gln Leu Met Glu Asp  
           595                          600                          605  
 Phe Val Leu Gly Val Ser Gly Ala Ala Phe Leu Gly Lys Met Asp Ser  
           610                          615                          620  
 Gln Lys Phe Asp Ala Glu Val Ser Arg Lys Gly Val Val Gly Ser Val  
           625                          630                          635                          640  
 Tyr Thr Gly Phe Leu Ala Gly Ser Trp Phe Phe Lys Gly Gln Tyr Ser  
                           645                          650                          655  
 Leu Gly Glu Thr Gln Asn Asp Met Lys Thr Arg Tyr Gly Val Leu Gly  
                           660                          665                          670  
 Glu Ser Ser Ala Ser Trp Thr Ser Arg Gly Val Leu Ala Asp Ala Leu  
                           675                          680                          685  
 Val Glu Tyr Arg Ser Leu Val Gly Pro Val Arg Pro Thr Phe Tyr Ala  
                           690                          695                          700  
 Leu His Phe Asn Pro Tyr Val Glu Val Ser Tyr Ala Ser Met Lys Phe  
                           705                          710                          715                          720  
 Pro Gly Phe Thr Glu Gln Gly Arg Glu Ala Arg Ser Phe Glu Asp Ala  
                           725                          730                          735  
 Ser Leu Thr Asn Ile Thr Ile Pro Leu Gly Met Lys Phe Glu Leu Ala  
                           740                          745                          750  
 Phe Ile Lys Gly Gln Phe Ser Glu Val Asn Ser Leu Gly Ile Ser Tyr  
                           755                          760                          765  
 Ala Trp Glu Ala Tyr Arg Lys Val Glu Gly Gly Ala Val Gln Leu Leu  
                           770                          775                          780  
 Glu Ala Gly Phe Asp Trp Glu Gly Ala Pro Met Asp Leu Pro Arg Gln  
                           785                          790                          795                          800  
 Glu Leu Arg Val Ala Leu Glu Asn Asn Thr Glu Trp Ser Ser Tyr Phe  
                           805                          810                          815  
 Ser Thr Val Leu Gly Leu Thr Ala Phe Cys Gly Gly Phe Thr Ser Thr  
                           820                          825                          830  
 Asp Ser Lys Leu Gly Tyr Glu Ala Asn Thr Gly Leu Arg Leu Ile Phe  
                           835                          840                          845

&lt;210&gt; 193

&lt;211&gt; 778

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 193

Met His His His His His His Gly Leu Ala Ser Cys Val Asp Leu His  
   1                          5                          10                          15  
 Ala Gly Gly Gln Ser Val Asn Glu Leu Val Tyr Val Gly Pro Gln Ala  
                           20                          25                          30  
 Val Leu Leu Leu Asp Gln Ile Arg Asp Leu Phe Val Gly Ser Lys Asp  
                           35                          40                          45  
 Ser Gln Ala Glu Gly Gln Tyr Arg Leu Ile Val Gly Asp Pro Ser Ser  
                           50                          55                          60  
 Phe Gln Glu Lys Asp Ala Asp Thr Leu Pro Gly Lys Val Glu Gln Ser  
                           65                          70                          75                          80  
 Thr Leu Phe Ser Val Thr Asn Pro Val Val Phe Gln Gly Val Asp Gln  
                           85                          90                          95  
 Gln Asp Gln Val Ser Ser Gln Gly Leu Ile Cys Ser Phe Thr Ser Ser  
                           100                          105                          110  
 Asn Leu Asp Ser Pro Arg Asp Gly Glu Ser Phe Leu Gly Ile Ala Phe  
                           115                          120                          125  
 Val Gly Asp Ser Ser Lys Ala Gly Ile Thr Leu Thr Asp Val Lys Ala  
                           130                          135                          140  
 Ser Leu Ser Gly Ala Ala Leu Tyr Ser Thr Glu Asp Leu Ile Phe Glu



145		150		155		160									
Lys	Ile	Lys	Gly	Gly	Leu	Glu	Phe	Ala	Ser	Cys	Ser	Ser	Leu	Glu	Gln
				165					170					175	
Gly	Gly	Ala	Cys	Ala	Ala	Gln	Ser	Ile	Leu	Ile	His	Asp	Cys	Gln	Gly
			180					185					190		
Leu	Gln	Val	Lys	His	Cys	Thr	Thr	Ala	Val	Asn	Ala	Glu	Gly	Ser	Ser
			195				200					205			
Ala	Asn	Asp	His	Leu	Gly	Phe	Gly	Gly	Gly	Ala	Phe	Phe	Val	Thr	Gly
	210					215				220					
Ser	Leu	Ser	Gly	Glu	Lys	Ser	Leu	Tyr	Met	Pro	Ala	Gly	Asp	Met	Val
225					230					235				240	
Val	Ala	Asn	Cys	Asp	Gly	Ala	Ile	Ser	Phe	Glu	Gly	Asn	Ser	Ala	Asn
				245					250					255	
Phe	Ala	Asn	Gly	Gly	Ala	Ile	Ala	Ala	Ser	Gly	Lys	Val	Leu	Phe	Val
			260					265					270		
Ala	Asn	Asp	Lys	Lys	Thr	Ser	Phe	Ile	Glu	Asn	Arg	Ala	Leu	Ser	Gly
		275					280					285			
Gly	Ala	Ile	Ala	Ala	Ser	Ser	Asp	Ile	Ala	Phe	Gln	Asn	Cys	Ala	Glu
	290					295				300					
Leu	Val	Phe	Lys	Gly	Asn	Cys	Ala	Ile	Gly	Thr	Glu	Asp	Lys	Gly	Ser
305					310					315				320	
Leu	Gly	Gly	Gly	Ala	Ile	Ser	Ser	Leu	Gly	Thr	Val	Leu	Leu	Gln	Gly
				325					330					335	
Asn	His	Gly	Ile	Thr	Cys	Asp	Lys	Asn	Glu	Ser	Ala	Ser	Gln	Gly	Gly
			340					345					350		
Ala	Ile	Phe	Gly	Lys	Asn	Cys	Gln	Ile	Ser	Asp	Asn	Glu	Gly	Pro	Val
		355					360					365			
Val	Phe	Arg	Asp	Ser	Thr	Ala	Cys	Leu	Gly	Gly	Gly	Ala	Ile	Ala	Ala
	370					375					380				
Gln	Glu	Ile	Val	Ser	Ile	Gln	Asn	Asn	Gln	Ala	Gly	Ile	Ser	Phe	Glu
385					390					395				400	
Gly	Gly	Lys	Ala	Ser	Phe	Gly	Gly	Gly	Ile	Ala	Cys	Gly	Ser	Phe	Ser
				405					410					415	
Ser	Ala	Gly	Gly	Ala	Ser	Val	Leu	Gly	Thr	Ile	Asp	Ile	Ser	Lys	Asn
		420						425					430		
Leu	Gly	Ala	Ile	Ser	Phe	Ser	Arg	Thr	Leu	Cys	Thr	Thr	Ser	Asp	Leu
		435					440					445			
Gly	Gln	Met	Glu	Tyr	Gln	Gly	Gly	Gly	Ala	Leu	Phe	Gly	Glu	Asn	Ile
		450				455				460					
Ser	Leu	Ser	Glu	Asn	Ala	Gly	Val	Leu	Thr	Phe	Lys	Asp	Asn	Ile	Val
465					470					475				480	
Lys	Thr	Phe	Ala	Ser	Asn	Gly	Lys	Ile	Leu	Gly	Gly	Gly	Ala	Ile	Leu
				485					490					495	
Ala	Thr	Gly	Lys	Val	Glu	Ile	Thr	Asn	Asn	Ser	Gly	Gly	Ile	Ser	Phe
			500					505					510		
Thr	Gly	Asn	Ala	Arg	Ala	Pro	Gln	Ala	Leu	Pro	Thr	Gln	Glu	Glu	Phe
		515					520					525			
Pro	Leu	Phe	Ser	Lys	Lys	Glu	Gly	Arg	Pro	Leu	Ser	Ser	Gly	Tyr	Ser
		530				535					540				
Gly	Gly	Gly	Ala	Ile	Leu	Gly	Arg	Glu	Val	Ala	Ile	Leu	His	Asn	Ala
545					550					555				560	
Ala	Val	Val	Phe	Glu	Gln	Asn	Arg	Leu	Gln	Cys	Ser	Glu	Glu	Glu	Ala
				565					570					575	
Thr	Leu	Leu	Gly	Cys	Cys	Gly	Gly	Gly	Ala	Val	His	Gly	Met	Asp	Ser
			580					585					590		
Thr	Ser	Ile	Val	Gly	Asn	Ser	Ser	Val	Arg	Phe	Gly	Asn	Asn	Tyr	Ala
		595				600						605			
Met	Gly	Gln	Gly	Val	Ser	Gly	Gly	Ala	Leu	Leu	Ser	Lys	Thr	Val	Gln

```

        610                615                620
Leu Ala Gly Asn Gly Ser Val Asp Phe Ser Arg Asn Ile Ala Ser Leu
625                630                635                640
Gly Gly Gly Ala Leu Gln Ala Ser Glu Gly Asn Cys Glu Leu Val Asp
        645                650                655
Asn Gly Tyr Val Leu Phe Arg Asp Asn Arg Gly Arg Val Tyr Gly Gly
        660                665                670
Ala Ile Ser Cys Leu Arg Gly Asp Val Val Ile Ser Gly Asn Lys Gly
        675                680                685
Arg Val Glu Phe Lys Asp Asn Ile Ala Thr Arg Leu Tyr Val Glu Glu
690                695                700
Thr Val Glu Lys Val Glu Glu Val Glu Pro Ala Pro Glu Gln Lys Asp
705                710                715                720
Asn Asn Glu Leu Ser Phe Leu Gly Ser Val Glu Gln Ser Phe Ile Thr
        725                730                735
Ala Ala Asn Gln Ala Leu Phe Ala Ser Glu Asp Gly Asp Leu Ser Pro
        740                745                750
Glu Ser Ser Ile Ser Ser Glu Glu Leu Ala Lys Arg Arg Glu Cys Ala
        755                760                765
Gly Gly Ala Asp Ser Ser Arg Ser Gly Cys
770                775

```

<210> 194  
 <211> 948  
 <212> PRT  
 <213> Chlamydia

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<400> 194
Met Ala Ser Met His His His His His Val Lys Ile Glu Asn Phe
 1                5                10                15
Ser Gly Gln Gly Ile Phe Ser Gly Asn Lys Ala Ile Asp Asn Thr Thr
        20                25                30
Glu Gly Ser Ser Ser Lys Ser Asn Val Leu Gly Gly Ala Val Tyr Ala
        35                40                45
Lys Thr Leu Phe Asn Leu Asp Ser Gly Ser Ser Arg Arg Thr Val Thr
50                55                60
Phe Ser Gly Asn Thr Val Ser Ser Gln Ser Thr Thr Gly Gln Val Ala
65                70                75                80
Gly Gly Ala Ile Tyr Ser Pro Thr Val Thr Ile Ala Thr Pro Val Val
        85                90                95
Phe Ser Lys Asn Ser Ala Thr Asn Asn Ala Asn Asn Ala Thr Asp Thr
        100                105                110
Gln Arg Lys Asp Thr Phe Gly Gly Ala Ile Gly Ala Thr Ser Ala Val
        115                120                125
Ser Leu Ser Gly Gly Ala His Phe Leu Glu Asn Val Ala Asp Leu Gly
130                135                140
Ser Ala Ile Gly Leu Val Pro Asp Thr Gln Asn Thr Glu Thr Val Lys
145                150                155                160
Leu Glu Ser Gly Ser Tyr Tyr Phe Glu Lys Asn Lys Ala Leu Lys Arg
        165                170                175
Ala Thr Ile Tyr Ala Pro Val Val Ser Ile Lys Ala Tyr Thr Ala Thr
        180                185                190
Phe Asn Gln Asn Arg Ser Leu Glu Glu Gly Ser Ala Ile Tyr Phe Thr
        195                200                205
Lys Glu Ala Ser Ile Glu Ser Leu Gly Ser Val Leu Phe Thr Gly Asn
210                215                220
Leu Val Thr Pro Thr Leu Ser Thr Thr Thr Glu Gly Thr Pro Ala Thr
225                230                235                240

```

Thr	Ser	Gly	Asp	Val	Thr	Lys	Tyr	Gly	Ala	Ala	Ile	Phe	Gly	Gln	Ile	245	250	255
Ala	Ser	Ser	Asn	Gly	Ser	Gln	Thr	Asp	Asn	Leu	Pro	Leu	Lys	Leu	Ile	260	265	270
Ala	Ser	Gly	Gly	Asn	Ile	Cys	Phe	Arg	Asn	Asn	Glu	Tyr	Arg	Pro	Thr	275	280	285
Ser	Ser	Asp	Thr	Gly	Thr	Ser	Thr	Phe	Cys	Ser	Ile	Ala	Gly	Asp	Val	290	295	300
Lys	Leu	Thr	Met	Gln	Ala	Ala	Lys	Gly	Lys	Thr	Ile	Ser	Phe	Phe	Asp	305	310	315
Ala	Ile	Arg	Thr	Ser	Thr	Lys	Lys	Thr	Gly	Thr	Gln	Ala	Thr	Ala	Tyr	325	330	335
Asp	Thr	Leu	Asp	Ile	Asn	Lys	Ser	Glu	Asp	Ser	Glu	Thr	Val	Asn	Ser	340	345	350
Ala	Phe	Thr	Gly	Thr	Ile	Leu	Phe	Ser	Ser	Glu	Leu	His	Glu	Asn	Lys	355	360	365
Ser	Tyr	Ile	Pro	Gln	Asn	Val	Val	Leu	His	Ser	Gly	Ser	Leu	Val	Leu	370	375	380
Lys	Pro	Asn	Thr	Glu	Leu	His	Val	Ile	Ser	Phe	Glu	Gln	Lys	Glu	Gly	385	390	395
Ser	Ser	Leu	Val	Met	Thr	Pro	Gly	Ser	Val	Leu	Ser	Asn	Gln	Thr	Val	405	410	415
Ala	Asp	Gly	Ala	Leu	Val	Ile	Asn	Asn	Met	Thr	Ile	Asp	Leu	Ser	Ser	420	425	430
Val	Glu	Lys	Asn	Gly	Ile	Ala	Glu	Gly	Asn	Ile	Phe	Thr	Pro	Pro	Glu	435	440	445
Leu	Arg	Ile	Ile	Asp	Thr	Thr	Thr	Ser	Gly	Ser	Gly	Gly	Thr	Pro	Ser	450	455	460
Thr	Asp	Ser	Glu	Ser	Asn	Gln	Asn	Ser	Asp	Asp	Thr	Lys	Glu	Gln	Asn	465	470	475
Asn	Asn	Asp	Ala	Ser	Asn	Gln	Gly	Glu	Ser	Ala	Asn	Gly	Ser	Ser	Ser	485	490	495
Pro	Ala	Val	Ala	Ala	Ala	His	Thr	Ser	Arg	Thr	Arg	Asn	Phe	Ala	Ala	500	505	510
Ala	Ala	Thr	Ala	Thr	Pro	Thr	Thr	Thr	Pro	Thr	Ala	Thr	Thr	Thr	Thr	515	520	525
Ser	Asn	Gln	Val	Ile	Leu	Gly	Gly	Glu	Ile	Lys	Leu	Ile	Asp	Pro	Asn	530	535	540
Gly	Thr	Phe	Phe	Gln	Asn	Pro	Ala	Leu	Arg	Ser	Asp	Gln	Gln	Ile	Ser	545	550	555
Leu	Leu	Val	Leu	Pro	Thr	Asp	Ser	Ser	Lys	Met	Gln	Ala	Gln	Lys	Ile	565	570	575
Val	Leu	Thr	Gly	Asp	Ile	Ala	Pro	Gln	Lys	Gly	Tyr	Thr	Gly	Thr	Leu	580	585	590
Thr	Leu	Asp	Pro	Asp	Gln	Leu	Gln	Asn	Gly	Thr	Ile	Ser	Ala	Leu	Trp	595	600	605
Lys	Phe	Asp	Ser	Tyr	Arg	Gln	Trp	Ala	Tyr	Val	Pro	Arg	Asp	Asn	His	610	615	620
Phe	Tyr	Ala	Asn	Ser	Ile	Leu	Gly	Ser	Gln	Met	Ser	Met	Val	Thr	Val	625	630	635
Lys	Gln	Gly	Leu	Leu	Asn	Asp	Lys	Met	Asn	Leu	Ala	Arg	Phe	Asp	Glu	645	650	655
Val	Ser	Tyr	Asn	Asn	Leu	Trp	Ile	Ser	Gly	Leu	Gly	Thr	Met	Leu	Ser	660	665	670
Gln	Val	Gly	Thr	Pro	Thr	Ser	Glu	Glu	Phe	Thr	Tyr	Tyr	Ser	Arg	Gly	675	680	685
Ala	Ser	Val	Ala	Leu	Asp	Ala	Lys	Pro	Ala	His	Asp	Val	Ile	Val	Gly	690	695	700

Ala Ala Phe Ser Lys Met Ile Gly Lys Thr Lys Ser Leu Lys Arg Glu  
 705 710 715 720  
 Asn Asn Tyr Thr His Lys Gly Ser Glu Tyr Ser Tyr Gln Ala Ser Val  
 725 730 735  
 Tyr Gly Gly Lys Pro Phe His Phe Val Ile Asn Lys Lys Thr Glu Lys  
 740 745 750  
 Ser Leu Pro Leu Leu Leu Gln Gly Val Ile Ser Tyr Gly Tyr Ile Lys  
 755 760 765  
 His Asp Thr Val Thr His Tyr Pro Thr Ile Arg Glu Arg Asn Gln Gly  
 770 775 780  
 Glu Trp Glu Asp Leu Gly Trp Leu Thr Ala Leu Arg Val Ser Ser Val  
 785 790 795 800  
 Leu Arg Thr Pro Ala Gln Gly Asp Thr Lys Arg Ile Thr Val Tyr Gly  
 805 810 815  
 Glu Leu Glu Tyr Ser Ser Ile Arg Gln Lys Gln Phe Thr Glu Thr Glu  
 820 825 830  
 Tyr Asp Pro Arg Tyr Phe Asp Asn Cys Thr Tyr Arg Asn Leu Ala Ile  
 835 840 845  
 Pro Met Gly Leu Ala Phe Glu Gly Glu Leu Ser Gly Asn Asp Ile Leu  
 850 855 860  
 Met Tyr Asn Arg Phe Ser Val Ala Tyr Met Pro Ser Ile Tyr Arg Asn  
 865 870 875 880  
 Ser Pro Thr Cys Lys Tyr Gln Val Leu Ser Ser Gly Glu Gly Gly Glu  
 885 890 895  
 Ile Ile Cys Gly Val Pro Thr Arg Asn Ser Ala Arg Gly Glu Tyr Ser  
 900 905 910  
 Thr Gln Leu Tyr Pro Gly Pro Leu Trp Thr Leu Tyr Gly Ser Tyr Thr  
 915 920 925  
 Ile Glu Ala Asp Ala His Thr Leu Ala His Met Met Asn Cys Gly Ala  
 930 935 940  
 Arg Met Thr Phe  
 945

&lt;210&gt; 195

&lt;211&gt; 821

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 195

Met His His His His His His Glu Ala Ser Ser Ile Gln Asp Gln Ile  
 1 5 10 15  
 Lys Asn Thr Asp Cys Asn Val Ser Lys Val Gly Tyr Ser Thr Ser Gln  
 20 25 30  
 Ala Phe Thr Asp Met Met Leu Ala Asp Asn Thr Glu Tyr Arg Ala Ala  
 35 40 45  
 Asp Ser Val Ser Phe Tyr Asp Phe Ser Thr Ser Ser Gly Leu Pro Arg  
 50 55 60  
 Lys His Leu Ser Ser Ser Ser Glu Ala Ser Pro Thr Thr Glu Gly Val  
 65 70 75 80  
 Ser Ser Ser Ser Ser Gly Glu Asn Thr Glu Asn Ser Gln Asp Ser Ala  
 85 90 95  
 Pro Ser Ser Gly Glu Thr Asp Lys Lys Thr Glu Glu Glu Leu Asp Asn  
 100 105 110  
 Gly Gly Ile Ile Tyr Ala Arg Glu Lys Leu Thr Ile Ser Glu Ser Gln  
 115 120 125  
 Asp Ser Leu Ser Asn Pro Ser Ile Glu Leu His Asp Asn Ser Phe Phe  
 130 135 140  
 Phe Gly Glu Gly Glu Val Ile Phe Asp His Arg Val Ala Leu Lys Asn

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145          150          155          160
Gly Gly Ala Ile Tyr Gly Glu Lys Glu Val Val Phe Glu Asn Ile Lys
          165          170          175
Ser Leu Leu Val Glu Val Asn Ile Ser Val Glu Lys Gly Gly Ser Val
          180          185          190
Tyr Ala Lys Glu Arg Val Ser Leu Glu Asn Val Thr Glu Ala Thr Phe
          195          200          205
Ser Ser Asn Gly Gly Glu Gln Gly Gly Gly Gly Ile Tyr Ser Glu Gln
          210          215          220
Asp Met Leu Ile Ser Asp Cys Asn Asn Val His Phe Gln Gly Asn Ala
225          230          235          240
Ala Gly Ala Thr Ala Val Lys Gln Cys Leu Asp Glu Glu Met Ile Val
          245          250          255
Leu Leu Thr Glu Cys Val Asp Ser Leu Ser Glu Asp Thr Leu Asp Ser
          260          265          270
Thr Pro Glu Thr Glu Gln Thr Lys Ser Asn Gly Asn Gln Asp Gly Ser
          275          280          285
Ser Glu Thr Lys Asp Thr Gln Val Ser Glu Ser Pro Glu Ser Thr Pro
          290          295          300
Ser Pro Asp Asp Val Leu Gly Lys Gly Gly Gly Ile Tyr Thr Glu Lys
305          310          315          320
Ser Leu Thr Ile Thr Gly Ile Thr Gly Thr Ile Asp Phe Val Ser Asn
          325          330          335
Ile Ala Thr Asp Ser Gly Ala Gly Val Phe Thr Lys Glu Asn Leu Ser
          340          345          350
Cys Thr Asn Thr Asn Ser Leu Gln Phe Leu Lys Asn Ser Ala Gly Gln
          355          360          365
His Gly Gly Gly Ala Tyr Val Thr Gln Thr Met Ser Val Thr Asn Thr
          370          375          380
Thr Ser Glu Ser Ile Thr Thr Pro Pro Leu Val Gly Glu Val Ile Phe
385          390          395          400
Ser Glu Asn Thr Ala Lys Gly His Gly Gly Gly Ile Cys Thr Asn Lys
          405          410          415
Leu Ser Leu Ser Asn Leu Lys Thr Val Thr Leu Thr Lys Asn Ser Ala
          420          425          430
Lys Glu Ser Gly Gly Ala Ile Phe Thr Asp Leu Ala Ser Ile Pro Thr
          435          440          445
Thr Asp Thr Pro Glu Ser Ser Thr Pro Ser Ser Ser Ser Pro Ala Ser
          450          455          460
Thr Pro Glu Val Val Ala Ser Ala Lys Ile Asn Arg Phe Phe Ala Ser
465          470          475          480
Thr Ala Glu Pro Ala Ala Pro Ser Leu Thr Glu Ala Glu Ser Asp Gln
          485          490          495
Thr Asp Gln Thr Glu Thr Ser Asp Thr Asn Ser Asp Ile Asp Val Ser
          500          505          510
Ile Glu Asn Ile Leu Asn Val Ala Ile Asn Gln Asn Thr Ser Ala Lys
          515          520          525
Lys Gly Gly Ala Ile Tyr Gly Lys Lys Ala Lys Leu Ser Arg Ile Asn
          530          535          540
Asn Leu Glu Leu Ser Gly Asn Ser Ser Gln Asp Val Gly Gly Gly Leu
545          550          555          560
Cys Leu Thr Glu Ser Val Glu Phe Asp Ala Ile Gly Ser Leu Leu Ser
          565          570          575
His Tyr Asn Ser Ala Ala Lys Glu Gly Gly Val Ile His Ser Lys Thr
          580          585          590
Val Thr Leu Ser Asn Leu Lys Ser Thr Phe Thr Phe Ala Asp Asn Thr
          595          600          605
Val Lys Ala Ile Val Glu Ser Thr Pro Glu Ala Pro Glu Glu Ile Pro

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        610                615                620
Pro Val Glu Gly Glu Glu Ser Thr Ala Thr Glu Asn Pro Asn Ser Asn
625                630                635                640
Thr Glu Gly Ser Ser Ala Asn Thr Asn Leu Glu Gly Ser Gln Gly Asp
        645                650                655
Thr Ala Asp Thr Gly Thr Gly Val Val Asn Asn Glu Ser Gln Asp Thr
        660                665                670
Ser Asp Thr Gly Asn Ala Glu Ser Gly Glu Gln Leu Gln Asp Ser Thr
        675                680                685
Gln Ser Asn Glu Glu Asn Thr Leu Pro Asn Ser Ser Ile Asp Gln Ser
        690                695                700
Asn Glu Asn Thr Asp Glu Ser Ser Asp Ser His Thr Glu Glu Ile Thr
705                710                715                720
Asp Glu Ser Val Ser Ser Ser Ser Lys Ser Gly Ser Ser Thr Pro Gln
        725                730                735
Asp Gly Gly Ala Ala Ser Ser Gly Ala Pro Ser Gly Asp Gln Ser Ile
        740                745                750
Ser Ala Asn Ala Cys Leu Ala Lys Ser Tyr Ala Ala Ser Thr Asp Ser
        755                760                765
Ser Pro Val Ser Asn Ser Ser Gly Ser Asp Val Thr Ala Ser Ser Asp
        770                775                780
Asn Pro Asp Ser Ser Ser Ser Gly Asp Ser Ala Gly Asp Ser Glu Gly
785                790                795                800
Pro Thr Glu Pro Glu Ala Gly Ser Thr Thr Glu Thr Pro Thr Leu Ile
        805                810                815
Gly Gly Gly Ala Ile
        820

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&lt;210&gt; 196

&lt;211&gt; 525

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 196

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Met His His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
        20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
        35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
        50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
        85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
        100         105         110
Val Thr Trp Gln Thr Lys Ser Gly Gly Thr Arg Thr Gly Asn Val Thr
        115         120         125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Pro Leu Val Pro Arg Gly Ser
        130         135         140
Pro Leu Pro Val Gly Asn Pro Ala Glu Pro Ser Leu Leu Ile Asp Gly
145         150         155         160
Thr Met Trp Glu Gly Ala Ser Gly Asp Pro Cys Asp Pro Cys Ala Thr
        165         170         175
Trp Cys Asp Ala Ile Ser Ile Arg Ala Gly Tyr Tyr Gly Asp Tyr Val
        180         185         190

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Phe Asp Arg Val Leu Lys Val Asp Val Asn Lys Thr Phe Ser Gly Met  
           195                          200                          205  
 Ala Ala Thr Pro Thr Gln Ala Ile Gly Asn Ala Ser Asn Thr Asn Gln  
           210                          215                          220  
 Pro Glu Ala Asn Gly Arg Pro Asn Ile Ala Tyr Gly Arg His Met Gln  
 225                          230                          235                          240  
 Asp Ala Glu Trp Phe Ser Asn Ala Ala Phe Leu Ala Leu Asn Ile Trp  
                           245                          250                          255  
 Asp Arg Phe Asp Ile Phe Cys Thr Leu Gly Ala Ser Asn Gly Tyr Phe  
                           260                          265                          270  
 Lys Ala Ser Ser Ala Ala Phe Asn Leu Val Gly Leu Ile Gly Phe Ser  
                           275                          280                          285  
 Ala Ala Ser Ser Ile Ser Thr Asp Leu Pro Met Gln Leu Pro Asn Val  
                           290                          295                          300  
 Gly Ile Thr Gln Gly Val Val Glu Phe Tyr Thr Asp Thr Ser Phe Ser  
 305                          310                          315                          320  
 Trp Ser Val Gly Ala Arg Gly Ala Leu Trp Glu Cys Gly Cys Ala Thr  
                           325                          330                          335  
 Leu Gly Ala Glu Phe Gln Tyr Ala Gln Ser Asn Pro Lys Ile Glu Met  
                           340                          345                          350  
 Leu Asn Val Thr Ser Ser Pro Ala Gln Phe Val Ile His Lys Pro Arg  
                           355                          360                          365  
 Gly Tyr Lys Gly Ala Ser Ser Asn Phe Pro Leu Pro Ile Thr Ala Gly  
                           370                          375                          380  
 Thr Thr Glu Ala Thr Asp Thr Lys Ser Ala Thr Ile Lys Tyr His Glu  
 385                          390                          395                          400  
 Trp Gln Val Gly Leu Ala Leu Ser Tyr Arg Leu Asn Met Leu Val Pro  
                           405                          410                          415  
 Tyr Ile Gly Val Asn Trp Ser Arg Ala Thr Phe Asp Ala Asp Thr Ile  
                           420                          425                          430  
 Arg Ile Ala Gln Pro Lys Leu Lys Ser Glu Ile Leu Asn Ile Thr Thr  
                           435                          440                          445  
 Trp Asn Pro Ser Leu Ile Gly Ser Thr Thr Ala Leu Pro Asn Asn Ser  
                           450                          455                          460  
 Gly Lys Asp Val Leu Ser Asp Val Leu Gln Ile Ala Ser Ile Gln Ile  
 465                          470                          475                          480  
 Asn Lys Met Lys Ser Arg Lys Ala Cys Gly Val Ala Val Gly Ala Thr  
                           485                          490                          495  
 Leu Ile Asp Ala Asp Lys Trp Ser Ile Thr Gly Glu Ala Arg Leu Ile  
                           500                          505                          510  
 Asn Glu Arg Ala Ala His Met Asn Ala Gln Phe Arg Phe  
                           515                          520                          525

&lt;210&gt; 197

&lt;211&gt; 43

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 197

gataggcgcg cgcgaatcat gaaatttatg tcagctactg ctg

43

&lt;210&gt; 198

&lt;211&gt; 34

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 198

cagaacgcgt ttagaatgtc atacgagcac cgca

34

<210> 199  
<211> 6  
<212> DNA  
<213> Chlamydia

<400> 199  
gcaatc 6

<210> 200  
<211> 34  
<212> DNA  
<213> Chlamydia

<400> 200  
tgcaatcatg agttcgcaga aagatataaa aagc 34

<210> 201  
<211> 38  
<212> DNA  
<213> Chlamydia

<400> 201  
cagagctagc ttaaaagatc aatcgcaatc cagtattc 38

<210> 202  
<211> 5  
<212> DNA  
<213> Chlamydia

<400> 202  
caatc 5

<210> 203  
<211> 31  
<212> DNA  
<213> Chlamydia

<400> 203  
tgcaatcatg aaaaaagcgt ttttcttttt c 31

<210> 204  
<211> 31  
<212> DNA  
<213> Chlamydia

<400> 204  
cagaacgcgt ctagaatcgc agagcaattt c 31

<210> 205  
<211> 30  
<212> DNA  
<213> Chlamydia

<400> 205  
gtgcaatcat gattcctcaa ggaatttacg 30

<210> 206



<211> 31  
<212> DNA  
<213> Chlamydia

<400> 206  
cagaacgcgt ttagaaccgg actttacttc c 31

<210> 207  
<211> 50  
<212> DNA  
<213> Chlamydia

<400> 207  
cagacatatg catcaccatc accatcacga ggcgagctcg atccaagatc 50

<210> 208  
<211> 40  
<212> DNA  
<213> Chlamydia

<400> 208  
cagaggtacc tcagatagca ctctctccta ttaaagtagg 40

<210> 209  
<211> 55  
<212> DNA  
<213> Chlamydia

<400> 209  
cagagctagc atgcatcacc atcaccatca cgtaaagatt gagaacttct ctggc 55

<210> 210  
<211> 35  
<212> DNA  
<213> Chlamydia

<400> 210  
cagaggtacc ttagaatgtc atacgagcac cgcag 35

<210> 211  
<211> 36  
<212> DNA  
<213> Chlamydia

<400> 211  
cagacatatg catcaccatc accatcacgg gttagc 36

<210> 212  
<211> 35  
<212> DNA  
<213> Chlamydia

<400> 212  
cagaggtacc tcagctcctc cagcacactc tcttc 35

<210> 213  
<211> 51  
<212> DNA

<213> Chlamydia

<400> 213

cagagctagc catcaccatc accatcacgg tgctatttct tgcttacgtg g 51

<210> 214

<211> 38

<212> DNA

<213> Chlamydia

<400> 214

cagaggtact taaaagatca atcgcaatcc agtattcg 38

<210> 215

<211> 48

<212> DNA

<213> Chlamydia

<400> 215

cagaggatcc acatcaccat caccatcacg gactagctag agaggttc 48

<210> 216

<211> 31

<212> DNA

<213> Chlamydia

<400> 216

cagagaattc ctagaatcgc agagcaattt c 31

<210> 217

<211> 7

<212> DNA

<213> Chlamydia

<400> 217

tgcaatc 7

<210> 218

<211> 22

<212> PRT

<213> Chlamydia

<400> 218

Met	Ala	Ser	Met	Thr	Gly	Gly	Gln	Gln	Met	Gly	Arg	Asp	Ser	Ser	Leu
1				5					10					15	
Val	Pro	Ser	Ser	Asp	Pro										
				20											

<210> 219

<211> 51

<212> DNA

<213> Chlamydia

<400> 219

cagagggtacc gcatcaccat caccatcaca tgattcctca aggaatttac g 51

<210> 220

<211> 33

<212> DNA  
<213> Chlamydia

<400> 220  
cagagcggcc gcttagaacc ggactttact tcc 33

<210> 221  
<211> 24  
<212> PRT  
<213> Chlamydia

<400> 221  
Met Ala Ser Met Thr Gly Gly Gln Gln Asn Gly Arg Asp Ser Ser Leu  
1 5 10 15  
Val Pro His His His His His His  
20

<210> 222  
<211> 46  
<212> DNA  
<213> Chlamydia

<400> 222  
cagagctagc catcaccatc accatcacct ctttgccag gatccc 46

<210> 223  
<211> 30  
<212> DNA  
<213> Chlamydia

<400> 223  
cagaactagt ctagaacctg taagtgggcc 30

<210> 224  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 224  
Met Ser Gln Lys Asn Lys Asn Ser Ala Phe Met His Pro Val Asn Ile  
1 5 10 15  
Ser Thr Asp Leu  
20

<210> 225  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 225  
Lys Asn Ser Ala Phe Met His Pro Val Asn Ile Ser Thr Asp Leu Ala  
1 5 10 15

Val Ile Val Gly  
20

<210> 226  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 226  
His Pro Val Asn Ile Ser Thr Asp Leu Ala Val Ile Val Gly Lys Gly  
1 5 10 15  
Pro Met Pro Arg  
20

<210> 227  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 227  
Ser Thr Asp Leu Ala Val Ile Val Gly Lys Gly Pro Met Pro Arg Thr  
1 5 10 15  
Glu Ile Val Lys  
20

<210> 228  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 228  
Val Ile Val Gly Lys Gly Pro Met Pro Arg Thr Glu Ile Val Lys Lys  
1 5 10 15  
Val Trp Glu Tyr  
20

<210> 229  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 229  
Gly Pro Met Pro Arg Thr Glu Ile Val Lys Lys Val Trp Glu Tyr Ile  
1 5 10 15  
Lys Lys His Asn  
20

<210> 230  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 230  
Ile Lys Lys His Asn Cys Gln Asp Gln Lys Asn Lys Arg Asn Ile Leu  
1 5 10 15  
Pro Asp Ala Asn  
20

<210> 231  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 231  
Asn Cys Gln Asp Gln Lys Asn Lys Arg Asn Ile Leu Pro Asp Ala Asn  
1 5 10 15  
Leu Ala Lys Val  
20

<210> 232  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 232  
Lys Asn Lys Arg Asn Ile Leu Pro Asp Ala Asn Leu Ala Lys Val Phe  
1 5 10 15  
Gly Ser Ser Asp  
20

<210> 233  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 233  
Ile Leu Pro Asp Ala Asn Leu Ala Lys Val Phe Gly Ser Ser Asp Pro  
1 5 10 15  
Ile Asp Met Phe  
20

<210> 234

<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 234  
Asn Leu Ala Lys Val Phe Gly Ser Ser Asp Pro Ile Asp Met Phe Gln  
1 5 10 15  
Met Thr Lys Ala  
20

<210> 235  
<211> 22  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 235  
Phe Gly Ser Ser Asp Pro Ile Asp Met Phe Gln Met Thr Lys Ala Leu  
1 5 10 15  
Ser Lys His Ile Val Lys  
20

<210> 236  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 236  
Val Glu Ile Thr Gln Ala Val Pro Lys Tyr Ala Thr Val Gly Ser Pro  
1 5 10 15  
Tyr Pro Val Glu  
20

<210> 237  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 237  
Ala Val Pro Lys Tyr Ala Thr Val Gly Ser Pro Tyr Pro Val Glu Ile  
1 5 10 15  
Thr Ala Thr Gly  
20

<210> 238  
<211> 20  
<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 238

Ala	Thr	Val	Gly	Ser	Pro	Tyr	Pro	Val	Glu	Ile	Thr	Ala	Thr	Gly	Lys
1				5					10					15	
Arg	Asp	Cys	Val												
				20											

<210> 239

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 239

Pro	Tyr	Pro	Val	Glu	Ile	Thr	Ala	Thr	Gly	Lys	Arg	Asp	Cys	Val	Asp
1				5					10					15	
Val	Ile	Ile	Thr												
				20											

<210> 240

<211> 21

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 240

Ile	Thr	Ala	Thr	Gly	Lys	Arg	Asp	Cys	Val	Asp	Val	Ile	Ile	Thr	Gln
1				5					10					15	
Gln	Leu	Pro	Cys	Glu											
				20											

<210> 241

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 241

Lys	Arg	Asp	Cys	Val	Asp	Val	Ile	Ile	Thr	Gln	Gln	Leu	Pro	Cys	Glu
1				5					10					15	
Ala	Glu	Phe	Val												
				20											

<210> 242

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 242

Asp Val Ile Ile Thr Gln Gln Leu Pro Cys Glu Ala Glu Phe Val Arg  
1 5 10 15  
Ser Asp Pro Ala  
20

<210> 243

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 243

Thr Gln Gln Leu Pro Cys Glu Ala Glu Phe Val Arg Ser Asp Pro Ala  
1 5 10 15  
Thr Thr Pro Thr  
20

<210> 244

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 244

Cys Glu Ala Glu Phe Val Arg Ser Asp Pro Ala Thr Thr Pro Thr Ala  
1 5 10 15  
Asp Gly Lys Leu  
20

<210> 245

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 245

Val Arg Ser Asp Pro Ala Thr Thr Pro Thr Ala Asp Gly Lys Leu Val  
1 5 10 15  
Trp Lys Ile Asp  
20

<210> 246

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab



&lt;400&gt; 246

Ala	Thr	Thr	Pro	Thr	Ala	Asp	Gly	Lys	Leu	Val	Trp	Lys	Ile	Asp	Arg
1				5					10					15	
Leu	Gly	Gln	Gly												
			20												

&lt;210&gt; 247

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 247

Ala	Asp	Gly	Lys	Leu	Val	Trp	Lys	Ile	Asp	Arg	Leu	Gly	Gln	Gly	Glu
1				5					10					15	
Lys	Ser	Lys	Ile												
			20												

&lt;210&gt; 248

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 248

Val	Trp	Lys	Ile	Asp	Arg	Leu	Gly	Gln	Gly	Glu	Lys	Ser	Lys	Ile	Thr
1				5					10					15	
Val	Trp	Val	Lys												
			20												

&lt;210&gt; 249

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 249

Arg	Leu	Gly	Gln	Gly	Glu	Lys	Ser	Lys	Ile	Thr	Val	Trp	Val	Lys	Pro
1				5					10					15	
Leu	Lys	Glu	Gly												
			20												

&lt;210&gt; 250

&lt;211&gt; 20

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; Made in a lab

&lt;400&gt; 250

Gly Glu Lys Ser Lys Ile Thr Val Trp Val Lys Pro Leu Lys Glu Gly  
1 5 10 15  
Cys Cys Phe Thr  
20

<210> 251  
<211> 16  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 251  
Gly Glu Lys Ser Lys Ile Thr Val Trp Val Lys Pro Leu Lys Glu Gly  
1 5 10 15

<210> 252  
<211> 12  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 252  
Lys Ile Thr Val Trp Val Lys Pro Leu Lys Glu Gly  
1 5 10

<210> 253  
<211> 16  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 253  
Gly Asp Lys Cys Lys Ile Thr Val Trp Val Lys Pro Leu Lys Glu Gly  
1 5 10 15

<210> 254  
<211> 20  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Made in a lab

<400> 254  
Thr Glu Tyr Pro Leu Leu Ala Asp Pro Ser Phe Lys Ile Ser Glu Ala  
1 5 10 15  
Phe Gly Val Leu  
20

<210> 255  
<211> 20  
<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 255

Leu Ala Asp Pro Ser Phe Lys Ile Ser Glu Ala Phe Gly Val Leu Asn  
1 5 10 15  
Pro Glu Gly Ser  
20

<210> 256

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 256

Phe Lys Ile Ser Glu Ala Phe Gly Val Leu Asn Pro Glu Gly Ser Leu  
1 5 10 15  
Ala Leu Arg Ala  
20

<210> 257

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 257

Ala Phe Gly Val Leu Asn Pro Glu Gly Ser Leu Ala Leu Arg Ala Thr  
1 5 10 15  
Phe Leu Ile Asp  
20

<210> 258

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 258

Asn Pro Glu Gly Ser Leu Ala Leu Arg Ala Thr Phe Leu Ile Asp Lys  
1 5 10 15  
His Gly Val Ile  
20

<210> 259

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 259

Leu Ala Leu Arg Ala Thr Phe Leu Ile Asp Lys His Gly Val Ile Arg  
1 5 10 15  
His Ala Val Ile  
20

<210> 260

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 260

Thr Phe Leu Ile Asp Lys His Gly Val Ile Arg His Ala Val Ile Asn  
1 5 10 15  
Asp Leu Pro Leu  
20

<210> 261

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 261

Lys His Gly Val Ile Arg His Ala Val Ile Asn Asp Leu Pro Leu Gly  
1 5 10 15  
Arg Ser Ile Asp  
20

<210> 262

<211> 20

<212> PRT

<213> Artificial Sequence

<220>

<223> Made in a lab

<400> 262

Arg His Ala Val Ile Asn Asp Leu Pro Leu Gly Arg Ser Ile Asp Glu  
1 5 10 15  
Glu Leu Arg Ile  
20

<210> 263

<211> 897

<212> DNA

<213> Chlamydia

<220>

<221> misc\_feature

&lt;222&gt; (1)...(897)

&lt;223&gt; n = A,T,C or G

&lt;400&gt; 263

```

atggcttcta tatgcggacg tttaggggtct ggtacagggga atgctctaaa agcttttttt      60
acacagccca acaataaaaat ggcaagggta gtaaataaga cgaagggagt ggataagact      120
attaaggttg ccaagtctgc tgccgaattg accgcaaata ttttggaaca agctggaggc      180
gcggtctctt ccgcacacat tacagcttcc caagtgtcca aaggattagg ggatgcgaga      240
actgttgctg ctttagggaa tgcctttaac ggagcgttgc caggaacagt tcaaagtgcg      300
caaagcttct tctctcacat gaaagctgct agtcagaaaa cgcaagaagg ggatgagggg      360
ctcacagcag atctttgtgt gtctcataag cgcagagcgg ctgctgtgt ctgtatcatc      420
atcggaggaa ttacctacct cgcgacattc ggagctatcc gtccgattct gtttgtcaac      480
aaaatgctgg caaaaccgtt tctttcttcc caaactaaag caaatatggg atcttctgtt      540
agctatatta tggcgggctaa ccatgcagcg tctgtggtgg gtgctggact cgctatcagt      600
gcgnaaagag cagattgcga agcccgctgc gctcgtattg cgagagaaga gtcgttactc      660
gaagtgccgg gagaggaaaa tgcttgcgag aagaaagtgc ctggagagaa agccaagacg      720
ttcacgcgca tcaagtatgc actcctcact atgctcgaga agtttttgga atgcgttgcc      780
gacgttttca aattgggtgcc gctgcctatt acaatgggta ttcgtgcgat tgtggctgct      840
ggatgtacgt tcacttctgc aattattgga ttgtgcactt tctgcgccag agcataa      897

```

&lt;210&gt; 264

&lt;211&gt; 298

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; VARIANT

&lt;222&gt; (1)...(298)

&lt;223&gt; Xaa = Any Amino Acid

&lt;400&gt; 264

```

Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu
 1             5             10             15
Lys Ala Phe Phe Thr Gln Pro Asn Asn Lys Met Ala Arg Val Val Asn
      20             25             30
Lys Thr Lys Gly Val Asp Lys Thr Ile Lys Val Ala Lys Ser Ala Ala
      35             40             45
Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser
      50             55             60
Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Ala Arg
      65             70             75             80
Thr Val Val Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr
      85             90             95
Val Gln Ser Ala Gln Ser Phe Phe Ser His Met Lys Ala Ala Ser Gln
      100            105            110
Lys Thr Gln Glu Gly Asp Glu Gly Leu Thr Ala Asp Leu Cys Val Ser
      115            120            125
His Lys Arg Arg Ala Ala Ala Ala Val Cys Ser Ile Ile Gly Gly Ile
      130            135            140
Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile Leu Phe Val Asn
      145            150            155            160
Lys Met Leu Ala Lys Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met
      165            170            175
Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val
      180            185            190
Val Gly Ala Gly Leu Ala Ile Ser Ala Xaa Arg Ala Asp Cys Glu Ala
      195            200            205
Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Leu Leu Glu Val Pro Gly

```

```

      210              215              220
Glu Glu Asn Ala Cys Glu Lys Lys Val Ala Gly Glu Lys Ala Lys Thr
225              230              235              240
Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu
      245              250              255
Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met
      260              265              270
Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Ile
      275              280              285
Ile Gly Leu Cys Thr Phe Cys Ala Arg Ala
      290              295

```

<210> 265  
 <211> 897  
 <212> DNA  
 <213> Chlamydia

<220>  
 <221> misc\_feature  
 <222> (1)...(897)  
 <223> n = A,T,C or G

```

<400> 265
atggcttcta tatgcggacg tttaggggtct ggtacagggga atgctctaaa agctttttttt      60
acacagccca acaataaaaat ggcaagggta gtaaataaga cgaaggggaat ggataagact      120
attaagggttg ccaagtctgc tgccgaattg accgcaaata ttttgggaaca agctggagggc      180
gcgggctctt ccgcacacat tacagcttcc caagtgtcca aaggattagg ggatgcgaga      240
actgttgtcg ctttagggaa tgctttaac ggagcgttgc caggaacagt tcaaagtgcg      300
caaagcttct tctctcacat gaaagctgct agtcagaaaa cgcaagaagg ggatgagggg      360
ctcacagcag atctttgtgt gtctcataag cgcagagcgg ctgcggctgt ctgtagcatc      420
atcggaggaa ttacctacct cgcgacattc ggagctatcc gtccgattct gtttgtcaac      480
aaaatgctgg caaaaccgtt tctttcttcc caaactaaag caaatatggg atcttctgtt      540
agctatatta tggcggctaa ccatgcagcg tctgtggtgg gtgctggact cgctatcagt      600
gcgnaaagag cagattgcga agcccgtgc gctcgtattg cgagagaaga gtcgttactc      660
gaagtgcggg gagaggaaaa tgcttgcgag aagaaagtgc ctggagagaa agccaagacg      720
ttcacgcgca tcaagtatgc actcctcact atgctcgaga agtttttggg atgcgttgcc      780
gacgttttca aattggtgcc gctgcctatt acaatgggta ttcgtgcgat tgtggctgct      840
ggatgtacgt tcacttctgc aattattgga ttgtgcactt tctgcgccag agcataa      897

```

<210> 266  
 <211> 298  
 <212> PRT  
 <213> Chlamydia

<220>  
 <221> VARIANT  
 <222> (1)...(298)  
 <223> Xaa = Any Amino Acid

```

<400> 266
Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu
 1              5              10              15
Lys Ala Phe Phe Thr Gln Pro Asn Asn Lys Met Ala Arg Val Val Asn
      20              25              30
Lys Thr Lys Gly Met Asp Lys Thr Ile Lys Val Ala Lys Ser Ala Ala
      35              40              45
Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser
      50              55              60

```

Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Ala Arg  
65 70 75 80  
Thr Val Val Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr  
85 90 95  
Val Gln Ser Ala Gln Ser Phe Phe Ser His Met Lys Ala Ala Ser Gln  
100 105 110  
Lys Thr Gln Glu Gly Asp Glu Gly Leu Thr Ala Asp Leu Cys Val Ser  
115 120 125  
His Lys Arg Arg Ala Ala Ala Val Cys Ser Ile Ile Gly Gly Ile  
130 135 140  
Thr Tyr Leu Ala Thr Phe Gly Ala Ile Arg Pro Ile Leu Phe Val Asn  
145 150 155 160  
Lys Met Leu Ala Lys Pro Phe Leu Ser Ser Gln Thr Lys Ala Asn Met  
165 170 175  
Gly Ser Ser Val Ser Tyr Ile Met Ala Ala Asn His Ala Ala Ser Val  
180 185 190  
Val Gly Ala Gly Leu Ala Ile Ser Ala Xaa Arg Ala Asp Cys Glu Ala  
195 200 205  
Arg Cys Ala Arg Ile Ala Arg Glu Glu Ser Leu Leu Glu Val Pro Gly  
210 215 220  
Glu Glu Asn Ala Cys Glu Lys Lys Val Ala Gly Glu Lys Ala Lys Thr  
225 230 235 240  
Phe Thr Arg Ile Lys Tyr Ala Leu Leu Thr Met Leu Glu Lys Phe Leu  
245 250 255  
Glu Cys Val Ala Asp Val Phe Lys Leu Val Pro Leu Pro Ile Thr Met  
260 265 270  
Gly Ile Arg Ala Ile Val Ala Ala Gly Cys Thr Phe Thr Ser Ala Ile  
275 280 285  
Ile Gly Leu Cys Thr Phe Cys Ala Arg Ala  
290 295

&lt;210&gt; 267

&lt;211&gt; 680

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 267

```

tctatatcca tattgatagg aaaaaacgtc gcagaaagat tttagctatg acgtttatcc      60
gagcttttagg atattcaaca gatgcagata ttattgaaga gttcttttct gtagaggagc      120
gttccttacg ttcagagaag gattttgtcg cgttagttgg taaagtttta gctgataacg      180
tagttgatgc ggattcttca ttagtttacg ggaaagctgg agagaagcta agtactgcta      240
tgctaaaacg catcttagat acgggagtc aatctttgaa gattgctgtt ggcgagatg      300
aaaatcaccc aattattaag atgctcgcaa aagatcctac ggattcttac gaagctgctc      360
ttaagagattt ttatcgcaga ttacgaccag gagagcctgc aacttttagct aatgctcgat      420
ccacaattat gcgtttattc ttogatgcta aacgttataa tttaggccgc gttggacggt      480
ataaattaaa taaaaaatta ggcttcccat tagacgacga aacattatct caagtgactt      540
tgagaaaaga agatgttata ggcgcgttga aatatttgat tcgtttgcca atggcgatg      600
agaagacatc tatcgatgat attgaccatt tggcaaaccg acgagttcgc tctgttgga      660
aactaattca gaatcactgt                                     680

```

&lt;210&gt; 268

&lt;211&gt; 359

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 268

```

cttatgttct ggagaatggt gcaacaacat attaatcgaa ccagctcctc ctagtaacat      60
agaaaccaag cccttttgag aaaaaacctg tacttcgcat cctttagcca tttgttgaat      120

```

```

agctcctaac aaagagctaa ttttttccctc ttccttggtt ttctgaggcg ctgtggactc 180
taaatatagc aagtgtctctt ggaacacctc atcaacaatc gcttgctcta gattaggtat 240
agagactgtc tctccatcaa ttaaattggag tttcaaagta atatcccctt ccgtccctcc 300
atcacaagac tctatgaaag ctatctgatt ccatcgagca gaaatgtatg gggaaatac 359

```

<210> 269  
 <211> 124  
 <212> DNA  
 <213> Chlamydia

```

<400> 269
gatcgaatca attgagggag ctcattaaca agaatagctg cagtttcttt gcgttcttct 60
ggaataacaa gaaataggta atcggtacca ttgatagaac gaacacgaca aatcgagaa 120
ggtt 124

```

<210> 270  
 <211> 219  
 <212> DNA  
 <213> Chlamydia

```

<400> 270
gatcctgttg ggcctagtaa taatacgttg gatttcccat aactcacttg tttatcctgc 60
ataagagcac ggatacgctt atagtgggta tagacggcaa ccgaaatcgt ttttttcgcg 120
cgctcttgtc caatgacata agagtcgatg tggcgtttga tttcttttagg ggtaaacact 180
ctcagacttg ttggagagct tgtggaagat gttgcgatc 219

```

<210> 271  
 <211> 511  
 <212> DNA  
 <213> Chlamydia

<220>  
 <221> misc\_feature  
 <222> (1)...(511)  
 <223> n = A,T,C or G

```

<400> 271
ggatccgaat tcggcacgag gagaaaatat aggaggttcc akcatcgga gatctaatag 60
acaaagaggt tttggcatag atggctcctc cttgtacgtt caacgatgat tgggagggat 120
tgttatcgat agcttggttc ccagagaact gacaagtcct gctacattga gagaatgtaa 180
cctgttctcc atagatagct cctcctacta cacctgaata agttgggtgt gctggagatg 240
atgggtgcgc tgctgcggt gcttgtaggg aagcagcagc tgcagcaggt gctgaagctg 300
ttgttgcgac tctgtggat gaggagtttg ctttgttggt cgagaaagag aagcctgatt 360
tcagattaga aatatttaca gtttttagcat gtaagcctcc accttcttcc ccaacaaggt 420
tctctgttac agataaggag actagangca tctagtttta aagatttttt acagcagata 480
cctccaccta tctctgtagc ggagttctca g 511

```

<210> 272  
 <211> 598  
 <212> DNA  
 <213> Chlamydia

```

<400> 272
ctcttctct cctcaatcta gttctggagc aactacagtc tccgactcag gagactctag 60
ctctggctca aactcggata cctcaaaaac agttccagtc acagctaaag gcggtgggct 120
ttatactgat aagaatcttt cgattactaa catcacagga attatcgaaa ttgcaataaa 180
caaagcgaca gatgttggag gtgggtgctta cgtaaaagga acccttactt gtaaaaactc 240
tcaccgtcta caatttttga aaaactcttc cgataaacia ggtggaggaa tctacggaga 300

```



agacaacatc	accctatcta	at ttgacagg	gaagactcta	ttccaagaga	at actgccaa	360
aaaagagggc	ggtggactct	tcataaaagg	tacagataaa	gctcttacia	tgacaggact	420
ggatagtttc	tgtttaatta	ataacacatc	agaaaaacat	ggtggtggga	gcctttgtta	480
ccaaagaaat	ctctcagact	tacacctctt	gatgtggaaa	caattccagg	aatcacgcct	540
gtacatgggtg	aaacagtcac	tactggcaat	aaatctacag	gaggtaatgg	tggagggc	598

&lt;210&gt; 273

&lt;211&gt; 126

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 273

ggatccgaat	tcggcacgag	atgagcctta	tagtttaaca	aaagcttctc	acattccttc	60
gatagctttt	tattagccgt	ttttagcctc	ctaagttagat	ctcctcggtc	gtaacaaata	120
cgagag						126

&lt;210&gt; 274

&lt;211&gt; 264

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 274

ggatccgaat	tcggcacgag	ctctttttaa	tcttaattac	aaaaagacaa	attaattcaa	60
tttttcaaaa	aagaatttaa	acattaattg	ttgtaaaaaa	acaatattta	ttctaaaata	120
ataaccatag	ttacggggga	atctctttca	tggtttatct	tagagctcat	caaccctaggc	180
atagccttaa	aacatttcct	ttgaaagttc	accattcggt	ctccgataag	catcctcaaa	240
ttgctaaagc	tatgtggatt	acgg				264

&lt;210&gt; 275

&lt;211&gt; 359

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 275

ggatccgaat	tcggcacgag	ataaaacctg	aaccacaaca	aagatctaaa	acttcttgat	60
tttcagctgc	aaattctttt	agataaatat	caaccatttc	ttcagtttca	tatcttgga	120
ttaaaacttg	ttctctttaa	ttaattctag	tatttaagta	ttcaacatag	cccattatta	180
attgaattgg	ataattttgc	cttaataatt	cacattcttt	ttcagtaatt	ttagggttcta	240
aaccgtaccg	ctttttttct	aaaattaatg	tttcttcatt	attcatttta	taagccaactt	300
tcctttatatt	tttgattttg	ttctctctgt	agtaatgctt	caataatagt	taataattt	359

&lt;210&gt; 276

&lt;211&gt; 357

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 276

aaaacaattg	atataatttt	ttttttcata	acttccagac	tcctttctag	aaaagtcttt	60
atgggtagta	gtgactctaa	cgttttttat	tattaagacg	atccccggag	atccttttaa	120
tgatgaaaac	ggaaacatcc	tttcgccaga	aacttttagca	ctattaaaga	atcggttacgg	180
gtagataaag	cctttattca	cccagtatct	tatctatttg	aaatgtctgc	taacactaga	240
tttcggggaa	tctcttatct	acaaagatcg	aaatctcagc	attattgctg	ccgctcttcc	300
atcttccgct	attcttggac	ttgaaagctt	gtgtttactc	gtgccgaatt	cggatecc	357

&lt;210&gt; 277

&lt;211&gt; 505

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

<400> 277  
 ggatccgaat tgggcacgag ctctgtgccga ttgcttgctt cagtcacccc atcgggtatag 60  
 agcactaaaa gagactcctc ttcaagaacg agagtgtgag caggggtgagg aggaacttca 120  
 ggtaaaaatc ctaaggccat accaggatgc gacaggaaaag agatatctcc attaggagct 180  
 cggagacacg ctgggtttgtg gccacaagaa tagtattcta gttctctgtgt tgcgtaatga 240  
 taacaataaaa tgcatagtgt tacaacatc ccagattcag ctgtctgttg atagaagaga 300  
 gcagctgttt gttgaacggc ttcttgaata gaggagagct cactcaaaaa ggtatgtaac 360  
 atgtttttca ggaataagga gtaggcgcac gcattgactc ctttcccggg agcatcagca 420  
 acgattagaa agagtttagc ttggggacct tcgcctataa caaagatatc aaagaaatct 480  
 cctcctaccg taactgcagg aatat 505

<210> 278  
 <211> 407  
 <212> DNA  
 <213> Chlamydia

<400> 278  
 ggatccgaat tgggcacgag aactactgag caaattgggt atccaacttc ctctttacga 60  
 aagaaaaaca gaaggcattc tccataccaa gatttgctgc atcgacaata aaactccaat 120  
 ctttggctct gctaactgga gcggtgctgg tatgattaaa aactttgaag acctattcat 180  
 ccttcgcccc attacagaga cacagcttca ggcctttatg gacgtctggt ctcttctaga 240  
 aacaaatagc tcctatctgt cccagagag cgtgcttacg gccctactc cttcaagtag 300  
 acctactcaa caagatacag attctgatga cgaacaaccg agtaccagcc agcaagctat 360  
 ccgtatgaga aaataggatt agggaaacaa aacgacagca aaccaca 407

<210> 279  
 <211> 351  
 <212> DNA  
 <213> Chlamydia

<400> 279  
 ctctgtccgc ttacaggagg cttgtatcct ttaaaataga gtttttctta tgaccccatg 60  
 tggcgatagg cgggtcttag cgccgatagt agaaatatcg gttgggtttt gtccttgagg 120  
 ggatcgtata ctttttcaaa gtatgggtccc cgtatcgatt atctggaggc tcttatgtct 180  
 ttttttcata ctagaaaata taagcttacc ctacagaggac tcttggtgtt agcaggctgt 240  
 ttcttaatga acagctgttc ctctagtcca ggaaatcaac ccgctgatga gagcatctat 300  
 gtcttgctta tgaatcgcat gatttggtgat tctcgtgccg aattcggatc c 351

<210> 280  
 <211> 522  
 <212> DNA  
 <213> Chlamydia

<400> 280  
 ggatccgaat tgggcacgag cagaggaaaa aggcgatact cctcttgaag atcgtttcac 60  
 agaagatctt tccgaagtct ctggagaaga ttttcgagga ttgaaaaatt cgttcgatga 120  
 tgattcttct tctgacgaaa ttctcgatgc gtcacaaagt aaattttctg atccccaat 180  
 aaaggatcta gctcttgatt atctaattca aatagctccc tctgatggga aacttaagtc 240  
 cgctctcatt caggcaaagc atcaactgat gagccagaat cctcaggcga ttgttgagg 300  
 acgcaatggt ctgttagctt cagaaacctt tgcttcaga gcaaatatc ctccttcac 360  
 gcttcgctcc ttatatttcc aagtaacctc atccccctct aattgcgcta atttacatca 420  
 aatgcttgct tcttactcgc catcagagaa aaccgctgtt atggagtttc tagtgaatgg 480  
 catggtagca gattttaaatt cggagggccc ttccattcct cc 522

<210> 281  
 <211> 577  
 <212> DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 281

ggatccgaat	tgggcacgag	atgcttctat	tacaattggt	ttggatgcgg	aaaaagctta	60
ccagcttatt	ctagaaaagt	tgggagatca	aattcttggg	ggaattgctg	atactattgt	120
tgatagtaca	gtccaagata	ttttagacaa	aatcacaca	gaccttctc	taggtttgtt	180
gaaagctttt	aacaactttc	caatcactaa	taaaattcaa	tgcaacgggt	tattcactcc	240
caggaaacatt	gaaactttat	taggaggaac	tgaaatagga	aaattcacag	tcacacccaa	300
aagctctggg	agcatgttct	tagtctcagc	agatattatt	gcatacaaga	tgggaaggcgg	360
cgttggttcta	gcttttggtac	gagaagggtga	ttctaagccc	tacgcgatta	gttatggata	420
ctcatcaggc	gttcctaatt	tatgtagtct	aagaaccaga	attattaata	caggattgac	480
tccgacaacg	tattcattac	gtgtaggcgg	tttagaaagc	ggtgtggtat	gggttaatgc	540
cctttctaata	ggcaatgata	ttttaggaat	aacaaat			577

&lt;210&gt; 282

&lt;211&gt; 607

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 282

actmatcttc	cccgggctcg	agtgcggcgg	caagcttgctc	gacggagctc	gatacaaaaa	60
tgtgtgcgtg	tgaaccgctt	cttcaaaagc	ttgtcttaaa	agatattgtc	tcgcttccgg	120
attagttaca	tgtttaaaaa	ttgctagaac	aatattatct	ccaaccaagc	tctctgcggg	180
gctgaaaaaa	cctaaattca	aaagaatgac	tcgcgcgtca	tcttcagaaa	gacgatccga	240
cttcataaat	tcgatgtctt	tccccatggg	gatctctgta	gggagccagt	tatttgccga	300
gccattcaaa	taatgttccc	aagcccattt	gtacttaata	ggaacaagtt	ggttgacatc	360
gacctgggtg	cagttcacta	gacgcttgct	atthagatta	acgcgtttct	gttttccatc	420
taaaatatct	gcttgcataa	gaaccgttaa	ttttattggt	aatttatatg	attaattact	480
gacatgcttc	acacccttct	tccaaagaac	agacaggtgc	tttcttcgct	ctttcaacaa	540
taattcctgc	cgaagcagac	ttattcttca	tccaacgagg	ctgaattcct	ctcttattaa	600
tatctac						607

&lt;210&gt; 283

&lt;211&gt; 1077

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 283

ggatccgaat	tgggcacgag	aagttaacga	tgacgatttg	ttcctttggt	agagaaggag	60
caatcgaaac	taaagtgtcg	agagcatgtg	aagactccaa	tgcaggaata	atccccctcat	120
ttctagtaag	caggaaaaaa	gctcgtaacg	cctcttcac	ggtggctaata	gtataaaagg	180
ctcgtcctga	ctcatgcatt	tcggcatgat	ctggcccaac	tgaaggataa	tctaataccag	240
cggaaatgga	gtgagtttgt	aatacttgct	catcgctcat	ttgaagaaga	tacgaataaa	300
atccgtggaa	tactccaggt	cgccctggtg	caaaacgtgc	tgcatgtttt	cctgaagaaa	360
tgcccagtc	tcccccttcc	actccaatta	attggacttt	tggattcggg	ataaaatgat	420
ggaaaaatcc	aatagcgttg	gagccacctc	cgatacatgc	aatcagaata	tcaggatctc	480
ttcctgcaac	tgcatggatt	tgctctttca	cttcagcgct	tataacagac	tgaaaaaatc	540
gaacgatata	gggataagggt	aaaggctcta	aggccgatcc	taagcaatag	tgagtaaattg	600
agtgtgttgt	tgcccaatct	tgtagagctt	gattaactgc	atctttgagt	ccacaagatc	660
cttttggttac	agaaaacgact	tcagcaccta	aaaagcgcac	tttctctaca	tttggtttct	720
gtcgttccac	atcttttgct	cccattgtata	ctacacaatc	taatcctaga	taagcacacg	780
ctgttgctgt	tgctactcca	tgttggtccc	cactgttttc	agctacaaca	cgtgttttcc	840
caagatatatt	agcaagcaaa	cactgaccaa	gagcattatt	cagtttatgt	gctcctgtat	900
gcaaaaagatc	ttcgcgttta	agaaatactc	tagggccatc	aatagctcga	gcaaaattct	960
taacttcagt	cagaggagtt	tgtctccccg	catagttttt	caaaatacaa	tctagttcag	1020
ataaaaaact	ttgctgagtt	ttgagaatct	cccatccgcg	ttttagattc	tgtatag	1077

&lt;210&gt; 284

&lt;211&gt; 407

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 284

ggatccgaat	tcggcacgag	aactactgag	caaattgggt	atccaacttc	ctcttttacga	60
aagaaaaaca	gaaggcattc	tccataccaa	gatttggttc	atcgacaata	aaactccaat	120
ctttggctct	gctaactgga	gcggtgctgg	tatgattaaa	aactttgaag	acctattcat	180
ccttcgcccc	attacagaga	cacagcttca	ggcctttatg	gacgtctggg	ctcttctaga	240
aacaaatagc	tcctatctgt	ccccagagag	cgtgcttacg	gcccctactc	cttcaagtag	300
acctactcaa	caagatacag	attctgatga	cgaacaaccg	agtaccagcc	agcaagctat	360
cogtatgaga	aaataggatt	agggaacaaa	aacgacagca	aaccaca		407

&lt;210&gt; 285

&lt;211&gt; 802

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 285

ggatccgaat	tcggcacgag	ttagcttaat	gtctttgtca	tctctaccta	catttgcagc	60
taattctaca	ggcacaattg	gaatcgtaa	tttacgtcgc	tgccatagaag	agtctgctct	120
tgggaaaaaa	gaatctgctg	aattcgaaaa	gatgaaaaac	caattctcta	acagcatggg	180
gaagatggag	gaagaactgt	cttctatcta	ttccaagctc	caagacgacg	attacatgga	240
aggtctatcc	gagaccgcag	ctgcogaatt	aagaaaaaaa	ttcgaagatc	tatctgcaga	300
atacaacaca	gctcaagggc	agtattacca	aatattaaac	caaagtaatc	tcaagcgcac	360
gcaaaagatt	atggaagaag	tgaaaaaagc	ttctgaaaact	gtgcgtattc	aagaaggcct	420
gtcagtcctt	cctaacgaag	atattgtctt	atctatcgat	agttcggcag	ataaaaaccga	480
tgctgttatt	aaagttcctg	atgattcttt	tcaaaataat	taacatgcga	agctagccga	540
ggagtgcogt	atgtctcaat	ccacttattc	tcttgaacaa	ttagctgatt	ttttgaaagt	600
cgagtttcaa	ggaaatggag	ctactcttct	ttccggagtt	gaagagatcg	aggaagcaaaa	660
aacggcacac	atcacattct	tagataatga	aaaatatgct	aaacatttaa	aatcatcgga	720
agctggcgct	atcatcatat	ctcgaacaca	gtttcaaaaa	tatcgagact	tgaataaaaa	780
ctttcttata	acttctgagt	ct				802

&lt;210&gt; 286

&lt;211&gt; 588

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 286

ggatccgaat	tcggcacgag	gcaatattta	ctcccaacat	tacggttcca	aataagcgat	60
aagggtcttct	aataagggaag	ttaatgtaag	aggctttttt	attgcttttc	gtaaggtagt	120
attgcaaccg	cacgcgattg	aatgatacgc	aagccatttc	catcatggaa	aagaaccctt	180
ggacaaaaat	acaaaggagg	ttcactccta	accagaaaaa	gggagagtta	gtttccatgg	240
gttttccctta	tatacacccg	tttcacacaa	ttaggagccg	cgtctagtat	ttggaataga	300
aattgtcccc	aagcgaattt	tgttcctgtt	tcagggattt	ctcctaattg	ttctgtcagc	360
catccgccta	tggtaacgca	attagctgta	gtaggaagat	caactccaaa	caggtcatag	420
aaatcagaaa	gctcataggt	gcctgcagca	ataacaacat	tcttgtctga	gtgagcgaat	480
tgttttaaag	atgggcgatt	atgagctacc	tcacagagaga	ctatttttaa	tagatcattt	540
tgggtaatca	atccttctat	agacccatat	tcacaatga	taatctcg		588

&lt;210&gt; 287

&lt;211&gt; 489

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;220&gt;

&lt;221&gt; misc\_feature

&lt;222&gt; (1)...(489)

&lt;223&gt; n = A,T,C or G

&lt;400&gt; 287

agtgcctatt	gttttgcagg	ctttgtctga	tgatagcgat	accgtacgtg	agattgctgt	60
acaagtagct	gttatgtatg	gttctagttg	cttactgcgc	gccgtgggcg	atttagcgaa	120
aaatgattct	tctattcaag	tacgcacac	tgcttatcgt	gctgcagccg	tgttggagat	180
acaagatctt	gtgcctcatt	tacgagttgt	agtccaaaat	acacaattag	atggaacgga	240
aagaagagaa	gcttggagat	ctttatgtgt	tcttactcgg	cctcatagt	gtgtattaac	300
tggcatagat	caagctttaa	tgacctgtga	gatgttaaag	gaatatcctg	aaaagtgtac	360
ggaagaacag	attcgtacat	tattggctgc	agatcatcca	gaagtgcagg	tagctacttt	420
acagatcatt	ctgagaggag	gtagagtatt	ccggtcatct	tctataatgg	aatcggttct	480
cgtgccnt						489

&lt;210&gt; 288

&lt;211&gt; 191

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 288

ggatccgaat	tcaggatatg	ctgttgggtt	atcaataaaa	agggttttgc	cattttttaa	60
gacgactttg	tagataacgc	taggagctgt	agcaataata	tcgagatcaa	attctctaga	120
gattctctca	aagatgattt	ctaagtgcag	cagtcctaaa	aatccacagc	ggaacccaaa	180
tccgagagag	t					191

&lt;210&gt; 289

&lt;211&gt; 515

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 289

ggatccgaat	tcggcacgag	gagcgacgtg	aaatagtggg	atcttcccgt	attcttatta	60
cttctgcgtt	gccttacgca	aatggctcct	tgcattttgg	acatattacc	ggtgcttatt	120
tgcttgcaga	tgtttatgcy	cgttttcaga	gactacaagg	caaagagggt	ttgtatattt	180
gtggttctga	tgaatacggg	atcgcaatta	cccttaatgc	agagttggca	ggcatggggg	240
atcaagaata	tgctgacatg	tatcataagc	ttcataaaga	taccttcaag	aaattgggaa	300
tttctgtaga	tttcttttcc	agaactacga	acgcttatca	tcctgctatt	gtgcaagatt	360
tctatcgaaa	cttgcaggaa	cgcggactgg	tagagaatca	ggtgaccgaa	cagctgtatt	420
ctgaggaaga	aggggaagttt	ttagcggacc	gttatgttgt	aggctactgt	cccaagtgtg	480
ggtttgatcg	agctcgagga	gatgagtgtc	agcag			515

&lt;210&gt; 290

&lt;211&gt; 522

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 290

ggatccgaat	tcggcacgag	ggaggaatgg	aagggccctc	cgattktama	tctgctacca	60
tgccattcac	tagaaactcc	ataacagcgg	ttttctctga	tgccgagtaa	gaagcaagca	120
tttgatgtaa	attagcgcaa	ttagaggggg	atgaggttac	ttggaaatat	aaggagcgaa	180
gcgatgaagg	agatgtattt	gctctggaag	caaagggttc	tgaagctaac	agaacattgc	240
gtcctccaac	aatcgcttga	ggattctggc	tcacagttg	atgctttgcc	tgaatgagag	300
cggacttaag	tttcccatca	gagggagcta	tttgaattag	ataatcaaga	gctagatcct	360
ttattgtggg	atcagaaaat	ttacttgtga	gcgcacgcag	aatttcgtca	gaagaagaat	420
catcatcgaa	cgaatttttc	aatcctcgaa	aatcttctcc	agagacttcg	gaaagatcct	480
ctgtgaaaacg	atcttcaaga	ggagtatcgc	ctttttccyc	tg		522

&lt;210&gt; 291

&lt;211&gt; 1002

&lt;212&gt; DNA

&lt;213&gt; Chlamydia

&lt;400&gt; 291

```

atggcgacta acgcaattag atcggcagga agtgcagcaa gtaagatgct gctgccagtt      60
gccaaagaac cagcggctgt cagctccttt gctcagaaag ggattttattg tattcaacaa      120
ttttttacaa accctgggaa taagttagca aagttttagt gggcaacaaa aagtttagat      180
aaatgcttta agctaagtaa ggcggtttct gactgtgtcg taggatcgct ggaagaggcg      240
ggatgcacag gggacgcatt gacctccgcg agaaacgccc agggatatgtt aaaaacaact      300
cgagaagttg ttgccttagc taatgtgctc aatggagctg ttccatctat cgttaactcg      360
actcagaggt gttaccaata cacacgtcaa gccttcgagt taggaagcaa gacaaaagaa      420
agaaaaacgc ctggggagta tagtaaaatg ctattaactc gaggtgatta cctattggca      480
gcttccaggg aagcttgtac ggcagtcggt gcaacgactt actcagcgac attcgggtgtt      540
ttacgtccgt taatgttaat caataaactc acagcaaaac cattcttaga caaagcgact      600
gtaggcaatt ttggcacggc tgttgctgga attatgacca ttaatcatat ggcaggagtt      660
gctggtgctg ttggcggaat cgcattagaa caaaagctgt tcaaacgtgc gaaggaatcc      720
ctatacaatg agagatgtgc cttagaaaac caacaatctc agttgagtggt ggacgtgatt      780
ctaagcgcggt aaagggcatt acgtaaagaa cacgttgcta ctctaaaaag aaatgtttta      840
actcttcttg aaaaagcttt agagttggta gtggatggag tcaaactcat tcctttaccg      900
attacagtgg cttgctccgc tgcaatttct ggagcettga cggcagcatc cgcaggaatt      960
ggcttatata gcatatggca gaaaacaaag tctggcaaat aa                                1002

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&lt;210&gt; 292

&lt;211&gt; 333

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 292

```

Met Ala Thr Asn Ala Ile Arg Ser Ala Gly Ser Ala Ala Ser Lys Met
 1           5           10          15
Leu Leu Pro Val Ala Lys Glu Pro Ala Ala Val Ser Ser Phe Ala Gln
      20           25           30
Lys Gly Ile Tyr Cys Ile Gln Gln Phe Phe Thr Asn Pro Gly Asn Lys
      35           40           45
Leu Ala Lys Phe Val Gly Ala Thr Lys Ser Leu Asp Lys Cys Phe Lys
      50           55           60
Leu Ser Lys Ala Val Ser Asp Cys Val Val Gly Ser Leu Glu Glu Ala
      65           70           75           80
Gly Cys Thr Gly Asp Ala Leu Thr Ser Ala Arg Asn Ala Gln Gly Met
      85           90           95
Leu Lys Thr Thr Arg Glu Val Val Ala Leu Ala Asn Val Leu Asn Gly
      100          105          110
Ala Val Pro Ser Ile Val Asn Ser Thr Gln Arg Cys Tyr Gln Tyr Thr
      115          120          125
Arg Gln Ala Phe Glu Leu Gly Ser Lys Thr Lys Glu Arg Lys Thr Pro
      130          135          140
Gly Glu Tyr Ser Lys Met Leu Leu Thr Arg Gly Asp Tyr Leu Leu Ala
      145          150          155          160
Ala Ser Arg Glu Ala Cys Thr Ala Val Gly Ala Thr Thr Tyr Ser Ala
      165          170          175
Thr Phe Gly Val Leu Arg Pro Leu Met Leu Ile Asn Lys Leu Thr Ala
      180          185          190
Lys Pro Phe Leu Asp Lys Ala Thr Val Gly Asn Phe Gly Thr Ala Val
      195          200          205
Ala Gly Ile Met Thr Ile Asn His Met Ala Gly Val Ala Gly Ala Val
      210          215          220
Gly Gly Ile Ala Leu Glu Gln Lys Leu Phe Lys Arg Ala Lys Glu Ser

```

```

225          230          235          240
Leu Tyr Asn Glu Arg Cys Ala Leu Glu Asn Gln Gln Ser Gln Leu Ser
          245          250          255
Gly Asp Val Ile Leu Ser Ala Glu Arg Ala Leu Arg Lys Glu His Val
          260          265          270
Ala Thr Leu Lys Arg Asn Val Leu Thr Leu Leu Glu Lys Ala Leu Glu
          275          280          285
Leu Val Val Asp Gly Val Lys Leu Ile Pro Leu Pro Ile Thr Val Ala
          290          295          300
Cys Ser Ala Ala Ile Ser Gly Ala Leu Thr Ala Ala Ser Ala Gly Ile
          305          310          315          320
Gly Leu Tyr Ser Ile Trp Gln Lys Thr Lys Ser Gly Lys
          325          330

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<210> 293  
 <211> 7  
 <212> DNA  
 <213> Chlamydia

<400> 293  
 tgcaatc

7

<210> 294  
 <211> 196  
 <212> PRT  
 <213> Chlamydia

```

<400> 294
Thr Met Gly Ser Leu Val Gly Arg Gln Ala Pro Asp Phe Ser Gly Lys
          5          10          15

Ala Val Val Cys Gly Glu Glu Lys Glu Ile Ser Leu Ala Asp Phe Arg
          20          25          30

Gly Lys Tyr Val Val Leu Phe Phe Tyr Pro Lys Asp Phe Thr Tyr Val
          35          40          45

Cys Pro Thr Glu Leu His Ala Phe Gln Asp Arg Leu Val Asp Phe Glu
          50          55          60

Glu His Gly Ala Val Val Leu Gly Cys Ser Val Asp Asp Ile Glu Thr
          65          70          75          80

His Ser Arg Trp Leu Thr Val Ala Arg Asp Ala Gly Gly Ile Glu Gly
          85          90          95

Thr Glu Tyr Pro Leu Leu Ala Asp Pro Ser Phe Lys Ile Ser Glu Ala
          100          105          110

Phe Gly Val Leu Asn Pro Glu Gly Ser Leu Ala Leu Arg Ala Thr Phe
          115          120          125

Leu Ile Asp Lys His Gly Val Ile Arg His Ala Val Ile Asn Asp Leu
          130          135          140

Pro Leu Gly Arg Ser Ile Asp Glu Glu Leu Arg Ile Leu Asp Ser Leu
          145          150          155          160

```

Ile Phe Phe Glu Asn His Gly Met Val Cys Pro Ala Asn Trp Arg Ser  
165 170 175

Gly Glu Arg Gly Met Val Pro Ser Glu Glu Gly Leu Lys Glu Tyr Phe  
180 185 190

Gln Thr Met Asp  
195

```
<210> 295
<211> 181
<212> PRT
<213> Chlamydia
```

<400> 295  
Lys Gly Gly Lys Met Ser Thr Thr Ile Ser Gly Asp Ala Ser Ser Leu  
5 10 15

Pro Leu Pro Thr Ala Ser Cys Val Glu Thr Lys Ser Thr Ser Ser Ser  
20 25 30

Thr Lys Gly Asn Thr Cys Ser Lys Ile Leu Asp Ile Ala Leu Ala Ile  
35 40 45

Val Gly Ala Leu Val Val Val Ala Gly Val Leu Ala Leu Val Leu Cys  
50 55 60

Ala Ser Asn Val Ile Phe Thr Val Ile Gly Ile Pro Ala Leu Ile Ile  
65 70 75 80

Gly Ser Ala Cys Val Gly Ala Gly Ile Ser Arg Leu Met Tyr Arg Ser  
85 90 95

Ser Tyr Ala Ser Leu Glu Ala Lys Asn Val Leu Ala Glu Gln Arg Leu  
100 105 110

Arg Asn Leu Ser Glu Glu Lys Asp Ala Leu Ala Ser Val Ser Phe Ile  
115 120 125

Asn Lys Met Phe Leu Arg Gly Leu Thr Asp Asp Leu Gln Ala Leu Glu  
130 135 140

Ala Lys Val Met Glu Phe Glu Ile Asp Cys Leu Asp Arg Leu Glu Lys  
145 150 155 160

Asn Glu Gln Ala Leu Leu Ser Asp Val Arg Leu Val Leu Ser Ser Tyr  
165 170 175

Thr Arg Trp Leu Asp  
180

```
<210> 296
<211> 124
<212> PRT
<213> Chlamydia
```



&lt;400&gt; 296

```

Ile Tyr Glu Val Met Asn Met Asp Leu Glu Thr Arg Arg Ser Phe Ala
      5              10              15

Val Gln Gln Gly His Tyr Gln Asp Pro Arg Ala Ser Asp Tyr Asp Leu
      20              25              30

Pro Arg Ala Ser Asp Tyr Asp Leu Pro Arg Ser Pro Tyr Pro Thr Pro
      35              40              45

Pro Leu Pro Ser Arg Tyr Gln Leu Gln Asn Met Asp Val Glu Ala Gly
      50              55              60

Phe Arg Glu Ala Val Tyr Ala Ser Phe Val Ala Gly Met Tyr Asn Tyr
      65              70              75              80

Val Val Thr Gln Pro Gln Glu Arg Ile Pro Asn Ser Gln Gln Val Glu
      85              90              95

Gly Ile Leu Arg Asp Met Leu Thr Asn Gly Ser Gln Thr Phe Ser Asn
      100             105             110

Leu Met Gln Arg Trp Asp Arg Glu Val Asp Arg Glu
      115             120

```

&lt;210&gt; 297

&lt;211&gt; 488

&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 297

```

Lys Gly Ser Leu Pro Ile Leu Gly Pro Phe Leu Asn Gly Lys Met Gly
      5              10              15

Phe Trp Arg Thr Ser Ile Met Lys Met Asn Arg Ile Trp Leu Leu Leu
      20              25              30

Leu Thr Phe Ser Ser Ala Ile His Ser Pro Val Arg Gly Glu Ser Leu
      35              40              45

Val Cys Lys Asn Ala Leu Gln Asp Leu Ser Phe Leu Glu His Leu Leu
      50              55              60

Gln Val Lys Tyr Ala Pro Lys Thr Trp Lys Glu Gln Tyr Leu Gly Trp
      65              70              75              80

Asp Leu Val Gln Ser Ser Val Ser Ala Gln Gln Lys Leu Arg Thr Gln
      85              90              95

Glu Asn Pro Ser Thr Ser Phe Cys Gln Gln Val Leu Ala Asp Phe Ile
      100             105             110

Gly Gly Leu Asn Asp Phe His Ala Gly Val Thr Phe Phe Ala Ile Glu
      115             120             125

Ser Ala Tyr Leu Pro Tyr Thr Val Gln Lys Ser Ser Asp Gly Arg Phe
      130             135             140

```

Tyr Phe Val Asp Ile Met Thr Phe Ser Ser Glu Ile Arg Val Gly Asp  
 145 150 155 160  
 Glu Leu Leu Glu Val Asp Gly Ala Pro Val Gln Asp Val Leu Ala Thr  
 165 170 175  
 Leu Tyr Gly Ser Asn His Lys Gly Thr Ala Ala Glu Glu Ser Ala Ala  
 180 185 190  
 Leu Arg Thr Leu Phe Ser Arg Met Ala Ser Leu Gly His Lys Val Pro  
 195 200 205  
 Ser Gly Arg Thr Thr Leu Lys Ile Arg Arg Pro Phe Gly Thr Thr Arg  
 210 215 220  
 Glu Val Arg Val Lys Trp Arg Tyr Val Pro Glu Gly Val Gly Asp Leu  
 225 230 235 240  
 Ala Thr Ile Ala Pro Ser Ile Arg Ala Pro Gln Leu Gln Lys Ser Met  
 245 250 255  
 Arg Ser Phe Phe Pro Lys Lys Asp Asp Ala Phe His Arg Ser Ser Ser  
 260 265 270  
 Leu Phe Tyr Ser Pro Met Val Pro His Phe Trp Ala Glu Leu Arg Asn  
 275 280 285  
 His Tyr Ala Thr Ser Gly Leu Lys Ser Gly Tyr Asn Ile Gly Ser Thr  
 290 295 300  
 Asp Gly Phe Leu Pro Val Ile Gly Pro Val Ile Trp Glu Ser Glu Gly  
 305 310 315 320  
 Leu Phe Arg Ala Tyr Ile Ser Ser Val Thr Asp Gly Asp Gly Lys Ser  
 325 330 335  
 His Lys Val Gly Phe Leu Arg Ile Pro Thr Tyr Ser Trp Gln Asp Met  
 340 345 350  
 Glu Asp Phe Asp Pro Ser Gly Pro Pro Pro Trp Glu Glu Phe Ala Lys  
 355 360 365  
 Ile Ile Gln Val Phe Ser Ser Asn Thr Glu Ala Leu Ile Ile Asp Gln  
 370 375 380  
 Thr Asn Asn Pro Gly Gly Ser Val Leu Tyr Leu Tyr Ala Leu Leu Ser  
 385 390 395 400  
 Met Leu Thr Asp Arg Pro Leu Glu Leu Pro Lys His Arg Met Ile Leu  
 405 410 415  
 Thr Gln Asp Glu Val Val Asp Ala Leu Asp Trp Leu Thr Leu Leu Glu  
 420 425 430  
 Asn Val Asp Thr Asn Val Glu Ser Arg Leu Ala Leu Gly Asp Asn Met  
 435 440 445

Glu Gly Tyr Thr Val Asp Leu Gln Val Ala Glu Tyr Leu Lys Ser Phe  
 450 455 460

Gly Arg Gln Val Leu Asn Cys Trp Ser Lys Gly Asp Ile Glu Leu Ser  
 465 470 475 480

Thr Pro Ile Pro Leu Phe Gly Phe  
 485

<210> 298  
 <211> 140  
 <212> PRT  
 <213> Chlamydia

<400> 298  
 Arg Ile Asp Ile Ser Ser Val Thr Phe Phe Ile Gly Ile Leu Leu Ala  
 5 10 15

Val Asn Ala Leu Thr Tyr Ser His Val Leu Arg Asp Leu Ser Val Ser  
 20 25 30

Met Asp Ala Leu Phe Ser Arg Asn Thr Leu Ala Val Leu Leu Gly Leu  
 35 40 45

Val Ser Ser Val Leu Asp Asn Val Pro Leu Val Ala Ala Thr Ile Gly  
 50 55 60

Met Tyr Asp Leu Pro Met Asn Asp Pro Leu Trp Lys Leu Ile Ala Tyr  
 65 70 75 80

Thr Ala Gly Thr Gly Gly Ser Ile Leu Ile Ile Gly Ser Ala Ala Gly  
 85 90 95

Val Ala Tyr Met Gly Met Glu Lys Val Ser Phe Gly Trp Tyr Val Lys  
 100 105 110

His Ala Ser Trp Ile Ala Leu Ala Ser Tyr Phe Gly Gly Leu Ala Val  
 115 120 125

Tyr Phe Leu Met Glu Asn Cys Val Asn Leu Phe Val  
 130 135 140

<210> 299  
 <211> 361  
 <212> PRT  
 <213> Chlamydia

<400> 299  
 His Gln Glu Ile Ala Asp Ser Pro Leu Val Lys Lys Ala Glu Glu Gln  
 5 10 15

Ile Asn Gln Ala Gln Gln Asp Ile Gln Thr Ile Thr Pro Ser Gly Leu  
 20 25 30

Asp Ile Pro Ile Val Gly Pro Ser Gly Ser Ala Ala Ser Ala Gly Ser  
 35 40 45

Ala Ala Gly Ala Leu Lys Ser Ser Asn Asn Ser Gly Arg Ile Ser Leu  
 50 55 60  
 Leu Leu Asp Asp Val Asp Asn Glu Met Ala Ala Ile Ala Met Gln Gly  
 65 70 75 80  
 Phe Arg Ser Met Ile Glu Gln Phe Asn Val Asn Asn Pro Ala Thr Ala  
 85 90 95  
 Lys Glu Leu Gln Ala Met Glu Ala Gln Leu Thr Ala Met Ser Asp Gln  
 100 105 110  
 Leu Val Gly Ala Asp Gly Glu Leu Pro Ala Glu Ile Gln Ala Ile Lys  
 115 120 125  
 Asp Ala Leu Ala Gln Ala Leu Lys Gln Pro Ser Ala Asp Gly Leu Ala  
 130 135 140  
 Thr Ala Met Gly Gln Val Ala Phe Ala Ala Lys Val Gly Gly Gly  
 145 150 155 160  
 Ser Ala Gly Thr Ala Gly Thr Val Gln Met Asn Val Lys Gln Leu Tyr  
 165 170 175  
 Lys Thr Ala Phe Ser Ser Thr Ser Ser Ser Tyr Ala Ala Ala Leu  
 180 185 190  
 Ser Asp Gly Tyr Ser Ala Tyr Lys Thr Leu Asn Ser Leu Tyr Ser Glu  
 195 200 205  
 Ser Arg Ser Gly Val Gln Ser Ala Ile Ser Gln Thr Ala Asn Pro Ala  
 210 215 220  
 Leu Ser Arg Ser Val Ser Arg Ser Gly Ile Glu Ser Gln Gly Arg Ser  
 225 230 235 240  
 Ala Asp Ala Ser Gln Arg Ala Ala Glu Thr Ile Val Arg Asp Ser Gln  
 245 250 255  
 Thr Leu Gly Asp Val Tyr Ser Arg Leu Gln Val Leu Asp Ser Leu Met  
 260 265 270  
 Ser Thr Ile Val Ser Asn Pro Gln Ala Asn Gln Glu Glu Ile Met Gln  
 275 280 285  
 Lys Leu Thr Ala Ser Ile Ser Lys Ala Pro Gln Phe Gly Tyr Pro Ala  
 290 295 300  
 Val Gln Asn Ser Val Asp Ser Leu Gln Lys Phe Ala Ala Gln Leu Glu  
 305 310 315 320  
 Arg Glu Phe Val Asp Gly Glu Arg Ser Leu Ala Glu Ser Gln Glu Asn  
 325 330 335  
 Ala Phe Arg Lys Gln Pro Ala Phe Ile Gln Gln Val Leu Val Asn Ile  
 340 345 350

Ala Ser Leu Phe Ser Gly Tyr Leu Ser  
           355                          360

<210> 300  
 <211> 207  
 <212> PRT  
 <213> Chlamydia

<400> 300  
 Ser Ser Lys Ile Val Ser Leu Cys Glu Gly Ala Val Ala Asp Ala Arg  
                   5                          10                  15  
 Met Cys Lys Ala Glu Leu Ile Lys Lys Glu Ala Asp Ala Tyr Leu Phe  
                   20                          25                  30  
 Cys Glu Lys Ser Gly Ile Tyr Leu Thr Lys Lys Glu Gly Ile Leu Ile  
                   35                          40                  45  
 Pro Ser Ala Gly Ile Asp Glu Ser Asn Thr Asp Gln Pro Phe Val Leu  
                   50                          55                  60  
 Tyr Pro Lys Asp Ile Leu Gly Ser Cys Asn Arg Ile Gly Glu Trp Leu  
                   65                          70                  75                  80  
 Arg Asn Tyr Phe Arg Val Lys Glu Leu Gly Val Ile Ile Thr Asp Ser  
                   85                          90                  95  
 His Thr Thr Pro Met Arg Arg Gly Val Leu Gly Ile Gly Leu Cys Trp  
                   100                         105                 110  
 Tyr Gly Phe Ser Pro Leu His Asn Tyr Ile Gly Ser Leu Asp Cys Phe  
                   115                         120                 125  
 Gly Arg Pro Leu Gln Met Thr Gln Ser Asn Leu Val Asp Ala Leu Ala  
                   130                         135                 140  
 Val Ala Ala Val Val Cys Met Gly Glu Gly Asn Glu Gln Thr Pro Leu  
                   145                         150                 155                 160  
 Ala Val Ile Glu Gln Ala Pro Asn Met Val Tyr His Ser Tyr Pro Thr  
                   165                         170                 175  
 Ser Arg Glu Glu Tyr Cys Ser Leu Arg Ile Asp Glu Thr Glu Asp Leu  
                   180                         185                 190  
 Tyr Gly Pro Phe Leu Gln Ala Val Thr Trp Ser Gln Glu Lys Lys  
                   195                         200                 205

<210> 301  
 <211> 183  
 <212> PRT  
 <213> Chlamydia

<400> 301  
 Ile Pro Pro Ala Pro Arg Gly His Pro Gln Ile Glu Val Thr Phe Asp  
                   5                          10                 15

Ile Asp Ala Asn Gly Ile Leu His Val Ser Ala Lys Asp Ala Ala Ser  
                   20                  25                  30  
 Gly Arg Glu Gln Lys Ile Arg Ile Glu Ala Ser Ser Gly Leu Lys Glu  
                   35                  40                  45  
 Asp Glu Ile Gln Gln Met Ile Arg Asp Ala Glu Leu His Lys Glu Glu  
                   50                  55                  60  
 Asp Lys Gln Arg Lys Glu Ala Ser Asp Val Lys Asn Glu Ala Asp Gly  
                   65                  70                  75                  80  
 Met Ile Phe Arg Ala Glu Lys Ala Val Lys Asp Tyr His Asp Lys Ile  
                   85                  90                  95  
 Pro Ala Glu Leu Val Lys Glu Ile Glu Glu His Ile Glu Lys Val Arg  
                   100                  105                  110  
 Gln Ala Ile Lys Glu Asp Ala Ser Thr Thr Ala Ile Lys Ala Ala Ser  
                   115                  120                  125  
 Asp Glu Leu Ser Thr Arg Met Gln Lys Ile Gly Glu Ala Met Gln Ala  
                   130                  135                  140  
 Gln Ser Ala Ser Ala Ala Ala Ser Ser Ala Ala Asn Ala Gln Gly Gly  
                   145                  150                  155                  160  
 Pro Asn Ile Asn Ser Glu Asp Leu Lys Lys His Ser Phe Ser Thr Arg  
                   165                  170                  175  
 Pro Pro Ala Gly Gly Ser Ala  
                   180

<210> 302  
 <211> 232  
 <212> PRT  
 <213> Chlamydia

<400> 302  
 Met Thr Lys His Gly Lys Arg Ile Arg Gly Ile Gln Glu Thr Tyr Asp  
                   5                  10                  15  
 Leu Ala Lys Ser Tyr Ser Leu Gly Glu Ala Ile Asp Ile Leu Lys Gln  
                   20                  25                  30  
 Cys Pro Thr Val Arg Phe Asp Gln Thr Val Asp Val Ser Val Lys Leu  
                   35                  40                  45  
 Gly Ile Asp Pro Arg Lys Ser Asp Gln Gln Ile Arg Gly Ser Val Ser  
                   50                  55                  60  
 Leu Pro His Gly Thr Gly Lys Val Leu Arg Ile Leu Val Phe Ala Ala  
                   65                  70                  75                  80  
 Gly Asp Lys Ala Ala Glu Ala Ile Glu Ala Gly Ala Asp Phe Val Gly  
                   85                  90                  95

Ser Asp Asp Leu Val Glu Lys Ile Lys Gly Gly Trp Val Asp Phe Asp  
 100 105 110  
 Val Ala Val Ala Thr Pro Asp Met Met Arg Glu Val Gly Lys Leu Gly  
 115 120 125  
 Lys Val Leu Gly Pro Arg Asn Leu Met Pro Thr Pro Lys Ala Gly Thr  
 130 135 140  
 Val Thr Thr Asp Val Val Lys Thr Ile Ala Glu Leu Arg Lys Gly Lys  
 145 150 155 160  
 Ile Glu Phe Lys Ala Asp Arg Ala Gly Val Cys Asn Val Gly Val Ala  
 165 170 175  
 Lys Leu Ser Phe Asp Ser Ala Gln Ile Lys Glu Asn Val Glu Ala Leu  
 180 185 190  
 Cys Ala Ala Leu Val Lys Ala Lys Pro Ala Thr Ala Lys Gly Gln Tyr  
 195 200 205  
 Leu Val Asn Phe Thr Ile Ser Ser Thr Met Gly Pro Gly Val Thr Val  
 210 215 220  
 Asp Thr Arg Glu Leu Ile Ala Leu  
 225 230  
  
 <210> 303  
 <211> 238  
 <212> PRT  
 <213> chlamydia  
  
 <400> 303  
 Ile Asn Ser Lys Leu Glu Thr Lys Asn Leu Ile Tyr Leu Lys Leu Lys  
 5 10 15  
 Ile Lys Lys Ser Phe Lys Met Gly Asn Ser Gly Phe Tyr Leu Tyr Asn  
 20 25 30  
 Thr Gln Asn Cys Val Phe Ala Asp Asn Ile Lys Val Gly Gln Met Thr  
 35 40 45  
 Glu Pro Leu Lys Asp Gln Gln Ile Ile Leu Gly Thr Thr Ser Thr Pro  
 50 55 60  
 Val Ala Ala Lys Met Thr Ala Ser Asp Gly Ile Ser Leu Thr Val Ser  
 65 70 75 80  
 Asn Asn Pro Ser Thr Asn Ala Ser Ile Thr Ile Gly Leu Asp Ala Glu  
 85 90 95  
 Lys Ala Tyr Gln Leu Ile Leu Glu Lys Leu Gly Asp Gln Ile Leu Gly  
 100 105 110  
 Gly Ile Ala Asp Thr Ile Val Asp Ser Thr Val Gln Asp Ile Leu Asp  
 115 120 125

Lys Ile Thr Thr Asp Pro Ser Leu Gly Leu Leu Lys Ala Phe Asn Asn  
 130 135 140  
 Phe Pro Ile Thr Asn Lys Ile Gln Cys Asn Gly Leu Phe Thr Pro Arg  
 145 150 155 160  
 Asn Ile Glu Thr Leu Leu Gly Gly Thr Glu Ile Gly Lys Phe Thr Val  
 165 170 175  
 Thr Pro Lys Ser Ser Gly Ser Met Phe Leu Val Ser Ala Asp Ile Ile  
 180 185 190  
 Ala Ser Arg Met Glu Gly Gly Val Val Leu Ala Leu Val Arg Glu Gly  
 195 200 205  
 Asp Ser Lys Pro Tyr Ala Ile Ser Tyr Gly Tyr Ser Ser Gly Val Pro  
 210 215 220  
 Asn Leu Cys Ser Leu Arg Thr Arg Ile Ile Asn Thr Gly Leu  
 225 230 235  
 <210> 304  
 <211> 133  
 <212> PRT  
 <213> Chlamydia  
 <400> 304  
 His Met His His His His His Met Ala Ser Ile Cys Gly Arg Leu  
 5 10 15  
 Gly Ser Gly Thr Gly Asn Ala Leu Lys Ala Phe Phe Thr Gln Pro Ser  
 20 25 30  
 Asn Lys Met Ala Arg Val Val Asn Lys Thr Lys Gly Met Asp Lys Thr  
 35 40 45  
 Val Lys Val Ala Lys Ser Ala Ala Glu Leu Thr Ala Asn Ile Leu Glu  
 50 55 60  
 Gln Ala Gly Gly Ala Gly Ser Ser Ala His Ile Thr Ala Ser Gln Val  
 65 70 75 80  
 Ser Lys Gly Leu Gly Asp Thr Arg Thr Val Val Ala Leu Gly Asn Ala  
 85 90 95  
 Phe Asn Gly Ala Leu Pro Gly Thr Val Gln Ser Ala Gln Ser Phe Phe  
 100 105 110  
 Ser His Met Lys Ala Ala Ser Gln Lys Thr Gln Glu Gly Asp Glu Gly  
 115 120 125  
 Leu Thr Ala Asp Leu  
 130

<210> 305  
 <211> 125



&lt;212&gt; PRT

&lt;213&gt; Chlamydia

&lt;400&gt; 305

```

Met Ala Ser Ile Cys Gly Arg Leu Gly Ser Gly Thr Gly Asn Ala Leu
                5                10                15

Lys Ala Phe Phe Thr Gln Pro Ser Asn Lys Met Ala Arg Val Val Asn
                20                25                30

Lys Thr Lys Gly Met Asp Lys Thr Val Lys Val Ala Lys Ser Ala Ala
                35                40                45

Glu Leu Thr Ala Asn Ile Leu Glu Gln Ala Gly Gly Ala Gly Ser Ser
                50                55                60

Ala His Ile Thr Ala Ser Gln Val Ser Lys Gly Leu Gly Asp Thr Arg
                65                70                75                80

Thr Val Val Ala Leu Gly Asn Ala Phe Asn Gly Ala Leu Pro Gly Thr
                85                90                95

Val Gln Ser Ala Gln Ser Phe Phe Ser His Met Lys Ala Ala Ser Gln
                100               105               110

Lys Thr Gln Glu Gly Asp Glu Gly Leu Thr Ala Asp Leu
                115               120               125

```

&lt;210&gt; 306

&lt;211&gt; 38

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 306

gagagcggcc gctcatgttt ataacaaagg aacttatg

38

&lt;210&gt; 307

&lt;211&gt; 39

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 307

gagagcggcc gcttacttag gtgagaagaa gggagtttc

39

&lt;210&gt; 308

&lt;211&gt; 1860

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 308

```

atgcatcacc atcaccatca cacggccgcg tccgataact tccagctgtc ccagggtggg      60
cagggattcg ccattccgat cgggcaggcg atggcgatcg cgggccagat caagcttccc      120
accgttcata tcgggcctac cgccttcctc ggcttgggtg ttgtcgacaa caacggcaac      180
ggcgcacgag tccaacgcgt ggtcgggagc gtcgcggcgg caagtctcgg catctccacc      240
ggcgacgtga tcaccgcggt cgacggcgct ccgatcaact cggccaccgc gatggcggac      300
gcgcttaacg ggcacatcc cggtgacgtc atctcgggtga cctggcaaac caagtcgggc      360

```

```

ggcacgcgta caggggaacgt gacattggcc gagggacccc cggccgaatt ctgcagatat 420
ccatcacact ggcggccgct catgtttata acaaaggaac ttatgaatcg agttatagaa 480
atccatgctc actacgatca aagacaactt tctcaatctc caaatacaaa cttcttagta 540
catcatcctt atcttactct tattcccaag tttctactag gagctctaata cgtctatgct 600
ccttattcgt ttgcagaaat ggaattagct atttctggac ataaacaagg taaagatcga 660
gataccttta ccatgatctc ttcctgtcct gaaggcacta attacatcat caatcgcaa 720
ctcatactca gtgatttctc gttactaaat aaagtttcat cagggggagc ctttcggaat 780
ctagcagggg aaatttcctt cttaggaaaa aattcttctg cgtocattca ttttaaacac 840
attaatatca atggttttgg agcgggagtc ttttctgaat cctctattga atttactgat 900
ttacgaaaac ttgttgcttt tggatctgaa agcacaggag gaatttttac tgcgaaagag 960
gacatctctt ttaaaaacaa ccaccacatt gccttcgcga ataatacac caaagggagt 1020
ggtggcgtta tccagctcca aggagatag aaaggaagcg tatcctttgt agatcaacgt 1080
ggagctatca tctttaccaa taaccaagct gtaacttctt catcaatgaa acatagtggg 1140
cgtggaggag caattagcgg tgacttcgca ggatccagaa ttctttttct taataaccaa 1200
caaattactt tcgaaggcaa tagcgtgtg catggagtg ctatctacaa taagaatggc 1260
cttgctgagt tcttaggaaa tgcaggacct cttgccttta aagagaacac aacaatagct 1320
aacgggggag ctatatacac aagtaatttc aaagcgaatc aacaaacatc ccccatctta 1380
ttctctcaaa atcatgcgaa taagaaaggg ggagcgattt acgcgcaata tgtgaactta 1440
gaacagaatc aagatactat tcgctttgaa aaaaataccg ctaaagaagg cggtggagcc 1500
atccactctt ctcaatgctc aattactgct cataatacca tcactttttc cgataatgct 1560
gccggagatc ttggaggagg agcaattctt ctagaaggga aaaaaccttc tctaaccttg 1620
attgctcata gtggtaatat tgcatttagc ggcaatacca tgcttcatat caccacaaaa 1680
gcttccctag atcgacacaa ttctatctta atcaaagaag ctccctataa aatccaactt 1740
gcagcgaaca aaaaccattc tattcatttc tttgatcctg tcatggcatt gtcagcatca 1800
tcttccctta tacaatcaa tgctcctgag tatgaaactc ccttcttctc acctaagtaa 1860

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&lt;210&gt; 309

&lt;211&gt; 619

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 309

```

Met His His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
 1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
 20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
 35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
 50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
 65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
 85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
100          105          110
Val Thr Trp Gln Thr Lys Ser Gly Gly Thr Arg Thr Gly Asn Val Thr
115          120          125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
130          135          140
Arg Pro Leu Met Phe Ile Thr Lys Glu Leu Met Asn Arg Val Ile Glu
145          150          155          160
Ile His Ala His Tyr Asp Gln Arg Gln Leu Ser Gln Ser Pro Asn Thr
165          170          175
Asn Phe Leu Val His His Pro Tyr Leu Thr Leu Ile Pro Lys Phe Leu
180          185          190
Leu Gly Ala Leu Ile Val Tyr Ala Pro Tyr Ser Phe Ala Glu Met Glu
195          200          205

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```

Leu Ala Ile Ser Gly His Lys Gln Gly Lys Asp Arg Asp Thr Phe Thr
 210                215                220
Met Ile Ser Ser Cys Pro Glu Gly Thr Asn Tyr Ile Ile Asn Arg Lys
225                230                235                240
Leu Ile Leu Ser Asp Phe Ser Leu Leu Asn Lys Val Ser Ser Gly Gly
 245                250                255
Ala Phe Arg Asn Leu Ala Gly Lys Ile Ser Phe Leu Gly Lys Asn Ser
 260                265                270
Ser Ala Ser Ile His Phe Lys His Ile Asn Ile Asn Gly Phe Gly Ala
 275                280                285
Gly Val Phe Ser Glu Ser Ser Ile Glu Phe Thr Asp Leu Arg Lys Leu
 290                295                300
Val Ala Phe Gly Ser Glu Ser Thr Gly Gly Ile Phe Thr Ala Lys Glu
305                310                315                320
Asp Ile Ser Phe Lys Asn Asn His His Ile Ala Phe Arg Asn Asn Ile
 325                330                335
Thr Lys Gly Asn Gly Gly Val Ile Gln Leu Gln Gly Asp Met Lys Gly
 340                345                350
Ser Val Ser Phe Val Asp Gln Arg Gly Ala Ile Ile Phe Thr Asn Asn
 355                360                365
Gln Ala Val Thr Ser Ser Ser Met Lys His Ser Gly Arg Gly Gly Ala
 370                375                380
Ile Ser Gly Asp Phe Ala Gly Ser Arg Ile Leu Phe Leu Asn Asn Gln
385                390                395                400
Gln Ile Thr Phe Glu Gly Asn Ser Ala Val His Gly Gly Ala Ile Tyr
 405                410                415
Asn Lys Asn Gly Leu Val Glu Phe Leu Gly Asn Ala Gly Pro Leu Ala
 420                425                430
Phe Lys Glu Asn Thr Thr Ile Ala Asn Gly Gly Ala Ile Tyr Thr Ser
 435                440                445
Asn Phe Lys Ala Asn Gln Gln Thr Ser Pro Ile Leu Phe Ser Gln Asn
 450                455                460
His Ala Asn Lys Lys Gly Gly Ala Ile Tyr Ala Gln Tyr Val Asn Leu
465                470                475                480
Glu Gln Asn Gln Asp Thr Ile Arg Phe Glu Lys Asn Thr Ala Lys Glu
 485                490                495
Gly Gly Gly Ala Ile Thr Ser Ser Gln Cys Ser Ile Thr Ala His Asn
 500                505                510
Thr Ile Thr Phe Ser Asp Asn Ala Ala Gly Asp Leu Gly Gly Gly Ala
 515                520                525
Ile Leu Leu Glu Gly Lys Lys Pro Ser Leu Thr Leu Ile Ala His Ser
 530                535                540
Gly Asn Ile Ala Phe Ser Gly Asn Thr Met Leu His Ile Thr Lys Lys
545                550                555                560
Ala Ser Leu Asp Arg His Asn Ser Ile Leu Ile Lys Glu Ala Pro Tyr
 565                570                575
Lys Ile Gln Leu Ala Ala Asn Lys Asn His Ser Ile His Phe Phe Asp
 580                585                590
Pro Val Met Ala Leu Ser Ala Ser Ser Ser Pro Ile Gln Ile Asn Ala
 595                600                605
Pro Glu Tyr Glu Thr Pro Phe Phe Ser Pro Lys
 610                615

```

&lt;210&gt; 310

&lt;211&gt; 39

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis



&lt;400&gt; 313

```

Met His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
 1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
          20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
          35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
 50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
 65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
          85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
          100          105          110
Val Thr Trp Gln Thr Lys Ser Gly Gly Thr Arg Thr Gly Asn Val Thr
          115          120          125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
 130          135          140
Arg Pro Leu His Ser Ile His Phe Phe Asp Pro Val Met Ala Leu Ser
 145          150          155          160
Ala Ser Ser Ser Pro Ile Gln Ile Asn Ala Pro Glu Tyr Glu Thr Pro
          165          170          175
Phe Phe Ser Pro Lys Gly Met Ile Val Phe Ser Gly Ala Asn Leu Leu
          180          185          190
Asp Asp Ala Arg Glu Asp Val Ala Asn Arg Thr Ser Ile Phe Asn Gln
          195          200          205
Pro Val His Leu Tyr Asn Gly Thr Leu Ser Ile Glu Asn Gly Ala His
 210          215          220
Leu Ile Val Gln Ser Phe Lys Gln Thr Gly Gly Arg Ile Ser Leu Ser
 225          230          235          240
Pro Gly Ser Ser Leu Ala Leu Tyr Thr Met Asn Ser Phe Phe His Gly
          245          250          255
Asn Ile Ser Ser Lys Glu Pro Leu Glu Ile Asn Gly Leu Ser Phe Gly
          260          265          270
Val Asp Ile Ser Pro Ser Asn Leu Gln Ala Glu Ile Arg Ala Gly Asn
          275          280          285
Ala Pro Leu Arg Leu Ser Gly Ser Pro Ser Ile His Asp Pro Glu Gly
          290          295          300
Leu Phe Tyr Glu Asn Arg Asp Thr Ala Ala Ser Pro Tyr Gln Met Glu
 305          310          315          320
Ile Leu Leu Thr Ser Asp Lys Thr Val Asp Ile Ser Lys Phe Thr Thr
          325          330          335
Asp Ser Leu Val Thr Asn Lys Gln Ser Gly Phe Gln Gly Ala Trp His
          340          345          350
Phe Ser Trp Gln Pro Asn Thr Ile Asn Asn Thr Lys Gln Lys Ile Leu
          355          360          365
Arg Ala Ser Trp Leu Pro Thr Gly Glu Tyr Val Leu Glu Ser Asn Arg
          370          375          380
Val Gly Arg Ala Val Pro Asn Ser Leu Trp Ser Thr Phe Leu Leu Leu
 385          390          395          400
Gln Thr Ala Ser His Asn Leu Gly Asp His Leu Cys Asn Asn Arg Ser
          405          410          415
Leu Ile Pro Thr Ser Tyr Phe Gly Val Leu Ile Gly Gly Thr Gly Ala
          420          425          430
Glu Met Ser Thr His Ser Ser Glu Glu Glu Ser Phe Ile Ser Arg Leu
          435          440          445
Gly Ala Thr Gly Thr Ser Ile Ile Arg Leu Thr Pro Ser Leu Thr Leu

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450                      455                      460  
 Ser Gly Gly Gly Ser His Met Phe Gly Asp Ser Phe Val Ala Asp Leu  
 465                      470                      475                      480  
 Pro Glu His Ile Thr Ser Glu Gly Ile Val Gln Asn Val Gly Leu Thr  
                     485                      490                      495  
 His Val Trp Gly Pro Leu Thr Val Asn Ser Thr Leu Cys Ala Ala Leu  
                     500                      505                      510  
 Asp His Asn Ala Met Val Arg Ile Cys Ser Lys Lys Asp His Thr Tyr  
                     515                      520                      525  
 Gly Lys Trp Asp Thr Phe Gly Met Arg Gly Thr Leu Gly Ala Ser Tyr  
                     530                      535                      540  
 Thr Phe Leu Glu Tyr Asp Gln Thr Met Arg Val Phe Ser Phe Ala Asn  
 545                      550                      555                      560  
 Ile Glu Ala Thr Asn Ile Leu Gln Arg Ala Phe Thr Glu Thr Gly Tyr  
                     565                      570                      575  
 Asn Pro Arg Ser Phe Ser Lys Thr Lys Leu Leu Asn Ile Ala Ile Pro  
                     580                      585                      590  
 Ile Gly Ile Gly Tyr Glu Phe Cys Leu Gly Asn Ser Ser Phe Ala Leu  
                     595                      600                      605  
 Leu Gly Lys Gly Ser Ile Gly Tyr Ser Arg Asp Ile Lys Arg Glu Asn  
                     610                      615                      620  
 Pro Ser Thr Leu Ala His Leu Ala Met Asn Asp Phe Ala Trp Thr Thr  
 625                      630                      635                      640  
 Asn Gly Cys Ser Val Pro Thr Ser Ala His Thr Leu Ala Asn Gln Leu  
                     645                      650                      655  
 Ile Leu Arg Tyr Lys Ala Cys Ser Leu Tyr Ile Thr Ala Tyr Thr Ile  
                     660                      665                      670  
 Asn Arg Glu Gly Lys Asn Leu Ser Asn Ser Leu Ser Cys Gly Gly Tyr  
                     675                      680                      685  
 Val Gly Phe  
 690

&lt;210&gt; 314

&lt;211&gt; 38

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 314

gagagcggcc gctcatgatt aaaagaactt ctctatcc

38

&lt;210&gt; 315

&lt;211&gt; 36

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 315

agcggccgct tataattctg catcatcttc tatggc

36

&lt;210&gt; 316

&lt;211&gt; 1941

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 316

atgcatcacc atcaccatca cacggccgcg tccgataact tccagctgtc ccagggtggg 60  
 cagggattcg ccattccgat cgggcaggcg atggcgatcg cgggccagat caagcttccc 120  
 accgttcata tcgggcctac cgccttcctc ggcttgggtg ttgtcgacaa caacggcaac 180  
 ggcgcacgag tccaacgcgt ggtcgggagc gtcccggcgg caagtctcgg catctccacc 240

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ggcgacgtga tcaccgcggt cgacggcgct cggatcaact cggccaccgc gatggcggac 300
gcgcttaacg ggcacatccc cggtagcgtc atctcgggtg cctggcaaac caagtcgggc 360
ggcacgcgta cagggaaacgt gacattggcc gagggacccc cggccgaatt ctgcagatat 420
ccatcacact ggcgcccgct catgattaaa agaacttctc tatcctttgc ttgcctcagt 480
tttttttatc tttcaactat atccattttg caagctaattg aaacgggatac gctacagttc 540
cggcgattta ctttttcgga tagagagatt cagttcgtcc tagatcccgc ctctttaatt 600
accgccc aaa acatcgtttt atctaattta cagtcaaacg gaaccggagc ctgtaccatt 660
tcaggcaata cgcaaacctca aatcttttct aattccgtta acaccaccgc agattctggt 720
ggagcctttg atatggttac tacctcatte acggcctctg ataatgctaa tctactcttc 780
tgcaacaact actgcacaca taataaaggc ggaggagcta ttcgttcggg aggacctatt 840
cgattcttaa ataactcaaga cgtgcttttt tataataaca tatcggcagg ggctaaatat 900
gttggaaacag gagatcacaa cgaaaaaaat aggggcggtg cgctttatgc aactactatc 960
actttgacag ggaatcgaaac tcttgccctt attaacaata tgtctggaga ctgcggtgga 1020
gccatctctg ctgacactca aatatcaata actgataccg ttaaagggaat tttatttgaa 1080
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gcaatctgta gtagaagaga cttgtgctca atcagcaata attctgggtcc catagttttt 1200
aactataacc aaggcgggaa aggtggagct attagcgcta cccgatgtgt tattgacaat 1260
aacaagaaa gaatcatctt ttcaaacaaat agttccctgg gatggagcca atcttcttct 1320
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tctatctact tcgacagcaa cactgctaca cagccggggg gagccattaa ctgtggttac 1440
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gcctttaatt tatcgaaacc acgttcagcg acaaattata tccatacagg gacaggcgat 1560
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gatactcgta tctattttta tgatcttttc caatgggagc gtgttaaaga aaatactagc 1740
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tctggagctg ttgtgttctc ctacaatcaa atgtctagtg acatacgaac tctgatgggt 1860
aaagaacaca attacattaa agaagcccca actactttaa aattcgggaac gctagccata 1920
gaagatgatg cagaattata a

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&lt;210&gt; 317

&lt;211&gt; 646

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 317

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Met His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
 1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
 20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
 35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
 50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
 65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
 85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
 100         105         110
Val Thr Trp Gln Thr Lys Ser Gly Gly Thr Arg Thr Gly Asn Val Thr
 115         120         125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
 130         135         140
Arg Pro Leu Met Ile Lys Arg Thr Ser Leu Ser Phe Ala Cys Leu Ser
 145         150         155         160
Phe Phe Tyr Leu Ser Thr Ile Ser Ile Leu Gln Ala Asn Glu Thr Asp
 165         170         175

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Thr Leu Gln Phe Arg Arg Phe Thr Phe Ser Asp Arg Glu Ile Gln Phe
      180                      185                      190
Val Leu Asp Pro Ala Ser Leu Ile Thr Ala Gln Asn Ile Val Leu Ser
      195                      200                      205
Asn Leu Gln Ser Asn Gly Thr Gly Ala Cys Thr Ile Ser Gly Asn Thr
      210                      215                      220
Gln Thr Gln Ile Phe Ser Asn Ser Val Asn Thr Thr Ala Asp Ser Gly
      225                      230                      235                      240
Gly Ala Phe Asp Met Val Thr Thr Ser Phe Thr Ala Ser Asp Asn Ala
      245                      250                      255
Asn Leu Leu Phe Cys Asn Asn Tyr Cys Thr His Asn Lys Gly Gly Gly
      260                      265                      270
Ala Ile Arg Ser Gly Gly Pro Ile Arg Phe Leu Asn Asn Gln Asp Val
      275                      280                      285
Leu Phe Tyr Asn Asn Ile Ser Ala Gly Ala Lys Tyr Val Gly Thr Gly
      290                      295                      300
Asp His Asn Glu Lys Asn Arg Gly Gly Ala Leu Tyr Ala Thr Thr Ile
      305                      310                      315                      320
Thr Leu Thr Gly Asn Arg Thr Leu Ala Phe Ile Asn Asn Met Ser Gly
      325                      330                      335
Asp Cys Gly Gly Ala Ile Ser Ala Asp Thr Gln Ile Ser Ile Thr Asp
      340                      345                      350
Thr Val Lys Gly Ile Leu Phe Glu Asn Asn His Thr Leu Asn His Ile
      355                      360                      365
Pro Tyr Thr Gln Ala Glu Asn Met Ala Arg Gly Gly Ala Ile Cys Ser
      370                      375                      380
Arg Arg Asp Leu Cys Ser Ile Ser Asn Asn Ser Gly Pro Ile Val Phe
      385                      390                      395                      400
Asn Tyr Asn Gln Gly Gly Lys Gly Gly Ala Ile Ser Ala Thr Arg Cys
      405                      410                      415
Val Ile Asp Asn Asn Lys Glu Arg Ile Ile Phe Ser Asn Asn Ser Ser
      420                      425                      430
Leu Gly Trp Ser Gln Ser Ser Ser Ala Ser Asn Gly Gly Ala Ile Gln
      435                      440                      445
Thr Thr Gln Gly Phe Thr Leu Arg Asn Asn Lys Gly Ser Ile Tyr Phe
      450                      455                      460
Asp Ser Asn Thr Ala Thr His Ala Gly Gly Ala Ile Asn Cys Gly Tyr
      465                      470                      475                      480
Ile Asp Ile Arg Asp Asn Gly Pro Val Tyr Phe Leu Asn Asn Ser Ala
      485                      490                      495
Ala Trp Gly Ala Ala Phe Asn Leu Ser Lys Pro Arg Ser Ala Thr Asn
      500                      505                      510
Tyr Ile His Thr Gly Thr Gly Asp Ile Val Phe Asn Asn Asn Val Val
      515                      520                      525
Phe Thr Leu Asp Gly Asn Leu Leu Gly Lys Arg Lys Leu Phe His Ile
      530                      535                      540
Asn Asn Asn Glu Ile Thr Pro Tyr Thr Leu Ser Leu Gly Ala Lys Lys
      545                      550                      555                      560
Asp Thr Arg Ile Tyr Phe Tyr Asp Leu Phe Gln Trp Glu Arg Val Lys
      565                      570                      575
Glu Asn Thr Ser Asn Asn Pro Pro Ser Pro Thr Ser Arg Asn Thr Ile
      580                      585                      590
Thr Val Asn Pro Glu Thr Glu Phe Ser Gly Ala Val Val Phe Ser Tyr
      595                      600                      605
Asn Gln Met Ser Ser Asp Ile Arg Thr Leu Met Gly Lys Glu His Asn
      610                      615                      620
Tyr Ile Lys Glu Ala Pro Thr Thr Leu Lys Phe Gly Thr Leu Ala Ile
      625                      630                      635                      640

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Glu Asp Asp Ala Glu Leu  
645

<210> 318  
<211> 34  
<212> DNA  
<213> Chlamydia trachomatis

<400> 318  
gagagcggcc gctcgacata cgaactctga tggg 34

<210> 319  
<211> 33  
<212> DNA  
<213> Chlamydia trachomatis

<400> 319  
gagagcggcc gcttaaaaga ccagagctcc tcc 33

<210> 320  
<211> 2148  
<212> DNA  
<213> Chlamydia trachomatis

<400> 320  
atgcatcacc atcaccatca cacggccggc tccgataact tccagctgtc ccagggtggg 60  
cagggattcg ccattccgat cgggcaggcg atggcgatcg cgggccagat caagcttccc 120  
accgttcata tcgggcctac cgccttcttc ggcttgggtg ttgtcgacaa caacggcaac 180  
ggcgacagag tccaacgcgt ggtcgggagc gctccggcgg caagtctcgg catctccacc 240  
ggcgacgtga tcaccgcggc cgacggcgct ccgatcaact cggccaccgc gatggcggac 300  
gcgcttaacg ggcacatccc cgggtgacgtc atctcgggtga cctggcaaac caagtccggc 360  
ggcacgcgta caggggaacgt gacattggcc gagggacccc cggccgaatt ctgcagatat 420  
ccatcacact ggcggccgct cgacatacga actctgatgg gtaaagaaca caattacatt 480  
aaagaagccc caactacttt aaaattcggga acgctagcca tagaagatga tgcagaatta 540  
gaaatcttca atatcccgtt tacccaaaat ccgactagcc ttcttgcttt aggaagcggc 600  
gctacgctga ctggttgaaa gcacggtaag ctcaatatta caaatcttgg tgttatttta 660  
cccattattc tcaaagaggg gaagagtccg ccttgctatc gcgccaacc acaagatatg 720  
acccaaaata ctggtaccgg ccaaactcca tcaagcacaa gtagtataag cactccaatg 780  
attatcttta atgggcgcct ctcaattgta gacgaaaatt atgaatcagt ctacgacagt 840  
atggacctct ccagagggaa agcagaacaa ctaattctat ccatagaaac cactaatgat 900  
gggcaattag actccaattg gcaaagttct ctgaatactt ctctactctc tctccacac 960  
tatggctatc aagggtctatg gactcctaatt tggataacaa caacctatac catcacgctt 1020  
aataataatt cttcagctcc aacatctgct acctccatcg ctgagcagaa aaaaactagt 1080  
gaaactttta ctctagtaa cacaactaca gctagtatcc ctaatattaa agcttccgca 1140  
ggatcaggct ctggatcggc ttccaattca ggagaagtta cgattaccaa acataccctt 1200  
gttgtaaaact gggcaccagt cggctacata gtagatccta ttcgtagagg agatctgata 1260  
gccaatagct tagtacattc aggaagaaac atgaccatgg gcttacgata attactcccg 1320  
gataactctt ggtttgcttt gcaaggagct gcaacaacat tatttataaa acaacaaaaa 1380  
cgtttgagtt atcatggcta ctctctgca tcaaaggggt ataccgtctc ttctcaagca 1440  
tcaggagctc atggtcataa gtttcttctt tcttctccc agtcatctga taagatgaaa 1500  
gaaaaagaaa caaataaccg cctttcttct cgttactatc tttctgcttt atgtttcgaa 1560  
catcctatgt ttgatcgcat tgctcttate ggagcagcag cttgcaatta tggaaacacat 1620  
aacatgcgga gtttctatgg aactaaaaaa tcttctaaag ggaaatttca ctctacaacc 1680  
ttaggagctt ctcttcgctg tgaactacgc gatagtatgc ctttacgata aataatgctc 1740  
accccatgtt gtcaggcttt attctctcga acagaaccag cttctatccg agaaagcggc 1800  
gatctagcta cttattttac attagagcaa gccatactg ccggttgctc tccaatagga 1860  
atcaaaggag cttattcttc tgatacatgg ccaacactct cttgggaaat ggaactagct 1920  
taccaaccca ccctctactg gaaacgtcct ctactcaaca cactattaat ccaaaataac 1980

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ggttcttggg tcaccacaaa taccccattha gctaaacatt ccttttatgg gagaggttct 2040
cactccctca aattttctca tctgaaacta tttgctaact atcaagcaga agtggctact 2100
tccactgtct cacactacat caatgcagga ggagctctgg tcttttaa 2148

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&lt;210&gt; 321

&lt;211&gt; 715

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 321

```

Met His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
 1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
          20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
          35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
          50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
          65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
          85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
          100          105          110
Val Thr Trp Gln Thr Lys Ser Gly Gly Thr Arg Thr Gly Asn Val Thr
          115          120          125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
          130          135          140
Arg Pro Leu Asp Ile Arg Thr Leu Met Gly Lys Glu His Asn Tyr Ile
          145          150          155          160
Lys Glu Ala Pro Thr Thr Leu Lys Phe Gly Thr Leu Ala Ile Glu Asp
          165          170          175
Asp Ala Glu Leu Glu Ile Phe Asn Ile Pro Phe Thr Gln Asn Pro Thr
          180          185          190
Ser Leu Leu Ala Leu Gly Ser Gly Ala Thr Leu Thr Val Gly Lys His
          195          200          205
Gly Lys Leu Asn Ile Thr Asn Leu Gly Val Ile Leu Pro Ile Ile Leu
          210          215          220
Lys Glu Gly Lys Ser Pro Pro Cys Ile Arg Val Asn Pro Gln Asp Met
          225          230          235          240
Thr Gln Asn Thr Gly Thr Gly Gln Thr Pro Ser Ser Thr Ser Ser Ile
          245          250          255
Ser Thr Pro Met Ile Ile Phe Asn Gly Arg Leu Ser Ile Val Asp Glu
          260          265          270
Asn Tyr Glu Ser Val Tyr Asp Ser Met Asp Leu Ser Arg Gly Lys Ala
          275          280          285
Glu Gln Leu Ile Leu Ser Ile Glu Thr Thr Asn Asp Gly Gln Leu Asp
          290          295          300
Ser Asn Trp Gln Ser Ser Leu Asn Thr Ser Leu Leu Ser Pro Pro His
          305          310          315          320
Tyr Gly Tyr Gln Gly Leu Trp Thr Pro Asn Trp Ile Thr Thr Thr Tyr
          325          330          335
Thr Ile Thr Leu Asn Asn Asn Ser Ser Ala Pro Thr Ser Ala Thr Ser
          340          345          350
Ile Ala Glu Gln Lys Lys Thr Ser Glu Thr Phe Thr Pro Ser Asn Thr
          355          360          365
Thr Thr Ala Ser Ile Pro Asn Ile Lys Ala Ser Ala Gly Ser Gly Ser
          370          375          380

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Gly Ser Ala Ser Asn Ser Gly Glu Val Thr Ile Thr Lys His Thr Leu  
 385 390 395 400  
 Val Val Asn Trp Ala Pro Val Gly Tyr Ile Val Asp Pro Ile Arg Arg  
 405 410 415  
 Gly Asp Leu Ile Ala Asn Ser Leu Val His Ser Gly Arg Asn Met Thr  
 420 425 430  
 Met Gly Leu Arg Ser Leu Leu Pro Asp Asn Ser Trp Phe Ala Leu Gln  
 435 440 445  
 Gly Ala Ala Thr Thr Leu Phe Thr Lys Gln Gln Lys Arg Leu Ser Tyr  
 450 455 460  
 His Gly Tyr Ser Ser Ala Ser Lys Gly Tyr Thr Val Ser Ser Gln Ala  
 465 470 475 480  
 Ser Gly Ala His Gly His Lys Phe Leu Leu Ser Phe Ser Gln Ser Ser  
 485 490 495  
 Asp Lys Met Lys Glu Lys Glu Thr Asn Asn Arg Leu Ser Ser Arg Tyr  
 500 505 510  
 Tyr Leu Ser Ala Leu Cys Phe Glu His Pro Met Phe Asp Arg Ile Ala  
 515 520 525  
 Leu Ile Gly Ala Ala Ala Cys Asn Tyr Gly Thr His Asn Met Arg Ser  
 530 535 540  
 Phe Tyr Gly Thr Lys Lys Ser Ser Lys Gly Lys Phe His Ser Thr Thr  
 545 550 555 560  
 Leu Gly Ala Ser Leu Arg Cys Glu Leu Arg Asp Ser Met Pro Leu Arg  
 565 570 575  
 Ser Ile Met Leu Thr Pro Phe Ala Gln Ala Leu Phe Ser Arg Thr Glu  
 580 585 590  
 Pro Ala Ser Ile Arg Glu Ser Gly Asp Leu Ala Arg Leu Phe Thr Leu  
 595 600 605  
 Glu Gln Ala His Thr Ala Val Val Ser Pro Ile Gly Ile Lys Gly Ala  
 610 615 620  
 Tyr Ser Ser Asp Thr Trp Pro Thr Leu Ser Trp Glu Met Glu Leu Ala  
 625 630 635 640  
 Tyr Gln Pro Thr Leu Tyr Trp Lys Arg Pro Leu Leu Asn Thr Leu Leu  
 645 650 655  
 Ile Gln Asn Asn Gly Ser Trp Val Thr Thr Asn Thr Pro Leu Ala Lys  
 660 665 670  
 His Ser Phe Tyr Gly Arg Gly Ser His Ser Leu Lys Phe Ser His Leu  
 675 680 685  
 Lys Leu Phe Ala Asn Tyr Gln Ala Glu Val Ala Thr Ser Thr Val Ser  
 690 695 700  
 His Tyr Ile Asn Ala Gly Gly Ala Leu Val Phe  
 705 710 715

&lt;210&gt; 322

&lt;211&gt; 37

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 322

gagagcggcc gctcatgcct ttttctttga gatctac

37

&lt;210&gt; 323

&lt;211&gt; 36

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 323

gagagcggcc gcttacacag atccattacc ggactg

36

<210> 324  
 <211> 1896  
 <212> DNA  
 <213> Chlamydia trachomatis

<400> 324  
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 cagggattcg ccattccgat cgggcaggcg atggcgatcg cgggccagat caagcttccc 120  
 accgttcata tcgggcctac cgccttcctc ggcttgggtg ttgtcgacaa caacggcaac 180  
 ggcgacgag tccaacgcgt ggtcgggagc gctccggcgg caagtctcgg catctccacc 240  
 ggcgacgtga tcaccgcggt cgacggcgct ccgatcaact cggccaccgc gatggcggac 300  
 gcgcttaacg ggcacatcc cggtgacgtc atctcgggtga cctggcgaac caagtcgggc 360  
 ggcacgcgta cagggaaagt gacattggcc gagggacccc cggccgaatt ctgcagatat 420  
 ccacacact ggcggccgct catgcctttt tctttgagat ctacatcatt ttgtttttta 480  
 gcttgtttgt gttcctattc gtatggatcc gcgagctctc ctcaagtgtt aacacctaata 540  
 gtaaccactc cttttaaggg ggacgatgtt tacttgaatg gagactgcgc ttttgtcaat 600  
 gtctatgcag gggcagagaa cggetcaatt atctcagcta atggcgacaa tttaacgatt 660  
 accggacaaa accatacatt atcatttaca gattctcaag ggccagttct tcaaaattat 720  
 gccttcattt cagcaggaga gacatttact ctgaaagatt ttccgagttt gatgttctcg 780  
 aaaaatgttt cttgcggaga aaaggggaatg atctcaggga aaaccgtgag tatttccgga 840  
 gcaggcgaag tgattttttg ggataactct gtggggtatt ctccctttgtc tatttgtcca 900  
 gcacgcactc caactcctcc agcaccagca ccagctcctg ctgcttcaag ctctttatct 960  
 ccaacagtta gtgatgctcg gaaagggctc atttttctg tagagactag tttggagatc 1020  
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 aatatgacga gtgatcgctc tggagagcgc agcgagcaa gaatcttaag tgatggaacg 1740  
 actgtttctt taaatgcttc cggactatcg aagctgatct tttatgatcc tggatgacaa 1800  
 aataattcag cagcgggtgc atcgacacca tcaccatctt cttcttctat gcctgggtgct 1860  
 gtcacgatta atcagtcagg taatggatct gtgtaa 1896

<210> 325  
 <211> 631  
 <212> PRT  
 <213> Chlamydia trachomatis

<400> 325  
 Met His His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu  
 1 5 10 15  
 Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala  
 20 25 30  
 Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala  
 35 40 45  
 Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val  
 50 55 60  
 Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr  
 65 70 75 80  
 Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr  
 85 90 95

Ala	Met	Ala	Asp	Ala	Leu	Asn	Gly	His	His	Pro	Gly	Asp	Val	Ile	Ser	100	105	110
Val	Thr	Trp	Gln	Thr	Lys	Ser	Gly	Gly	Thr	Arg	Thr	Gly	Asn	Val	Thr	115	120	125
Leu	Ala	Glu	Gly	Pro	Pro	Ala	Glu	Phe	Cys	Arg	Tyr	Pro	Ser	His	Trp	130	135	140
Arg	Pro	Leu	Met	Pro	Phe	Ser	Leu	Arg	Ser	Thr	Ser	Phe	Cys	Phe	Leu	145	150	155
Ala	Cys	Leu	Cys	Ser	Tyr	Ser	Tyr	Gly	Phe	Ala	Ser	Ser	Pro	Gln	Val	165	170	175
Leu	Thr	Pro	Asn	Val	Thr	Thr	Pro	Phe	Lys	Gly	Asp	Asp	Val	Tyr	Leu	180	185	190
Asn	Gly	Asp	Cys	Ala	Phe	Val	Asn	Val	Tyr	Ala	Gly	Ala	Glu	Asn	Gly	195	200	205
Ser	Ile	Ile	Ser	Ala	Asn	Gly	Asp	Asn	Leu	Thr	Ile	Thr	Gly	Gln	Asn	210	215	220
His	Thr	Leu	Ser	Phe	Thr	Asp	Ser	Gln	Gly	Pro	Val	Leu	Gln	Asn	Tyr	225	230	235
Ala	Phe	Ile	Ser	Ala	Gly	Glu	Thr	Leu	Thr	Leu	Lys	Asp	Phe	Ser	Ser	245	250	255
Leu	Met	Phe	Ser	Lys	Asn	Val	Ser	Cys	Gly	Glu	Lys	Gly	Met	Ile	Ser	260	265	270
Gly	Lys	Thr	Val	Ser	Ile	Ser	Gly	Ala	Gly	Glu	Val	Ile	Phe	Trp	Asp	275	280	285
Asn	Ser	Val	Gly	Tyr	Ser	Pro	Leu	Ser	Ile	Val	Pro	Ala	Ser	Thr	Pro	290	295	300
Thr	Pro	Pro	Ala	Pro	Ala	Pro	Ala	Pro	Ala	Ala	Ser	Ser	Ser	Leu	Ser	305	310	315
Pro	Thr	Val	Ser	Asp	Ala	Arg	Lys	Gly	Ser	Ile	Phe	Ser	Val	Glu	Thr	325	330	335
Ser	Leu	Glu	Ile	Ser	Gly	Val	Lys	Lys	Gly	Val	Met	Phe	Asp	Asn	Asn	340	345	350
Ala	Gly	Asn	Phe	Gly	Thr	Val	Phe	Arg	Gly	Asn	Ser	Asn	Asn	Asn	Ala	355	360	365
Gly	Ser	Gly	Gly	Ser	Gly	Ser	Ala	Thr	Thr	Pro	Ser	Phe	Thr	Val	Lys	370	375	380
Asn	Cys	Lys	Gly	Lys	Val	Ser	Phe	Thr	Asp	Asn	Val	Ala	Ser	Cys	Gly	385	390	395
Gly	Gly	Val	Val	Tyr	Lys	Gly	Thr	Val	Leu	Phe	Lys	Asp	Asn	Glu	Gly	405	410	415
Gly	Ile	Phe	Phe	Arg	Gly	Asn	Thr	Ala	Tyr	Asp	Asp	Leu	Gly	Ile	Leu	420	425	430
Ala	Ala	Thr	Ser	Arg	Asp	Gln	Asn	Thr	Glu	Thr	Gly	Gly	Gly	Gly	Gly	435	440	445
Val	Ile	Cys	Ser	Pro	Asp	Asp	Ser	Val	Lys	Phe	Glu	Gly	Asn	Lys	Gly	450	455	460
Ser	Ile	Val	Phe	Asp	Tyr	Asn	Phe	Ala	Lys	Gly	Arg	Gly	Gly	Ser	Ile	465	470	475
Leu	Thr	Lys	Glu	Phe	Ser	Leu	Val	Ala	Asp	Asp	Ser	Val	Val	Phe	Ser	485	490	495
Asn	Asn	Thr	Ala	Glu	Lys	Gly	Gly	Gly	Ala	Ile	Tyr	Ala	Pro	Thr	Ile	500	505	510
Asp	Ile	Ser	Thr	Asn	Gly	Gly	Ser	Ile	Leu	Phe	Glu	Arg	Asn	Arg	Ala	515	520	525
Ala	Glu	Gly	Gly	Ala	Ile	Cys	Val	Ser	Glu	Ala	Ser	Ser	Gly	Ser	Thr	530	535	540
Gly	Asn	Leu	Thr	Leu	Ser	Ala	Ser	Asp	Gly	Asp	Ile	Val	Phe	Ser	Gly	545	550	555

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gcagcctccc	attatgaaaa	tgggtcaata	tttggagttg	cttttggaca	actctatggt		1440
caqacaaaqa	qcaqaatqta	ttactctaaa	qatqctqqa	acatqacrat	qttctctct		1500

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&lt;210&gt; 329

&lt;211&gt; 715

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 329

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Met His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
 1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
          20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
          35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
          50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
          65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
          85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
          100          105          110
Val Thr Trp Gln Thr Lys Ser Gly Gly Thr Arg Thr Gly Asn Val Thr
          115          120          125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
          130          135          140
Arg Pro Leu Asp Pro Val Val Gln Asn Asn Ser Ala Ala Gly Ala Ser
          145          150          155          160
Thr Pro Ser Pro Ser Ser Ser Ser Met Pro Gly Ala Val Thr Ile Asn
          165          170          175
Gln Ser Gly Asn Gly Ser Val Ile Phe Thr Ala Glu Ser Leu Thr Pro
          180          185          190
Ser Glu Lys Leu Gln Val Leu Asn Ser Thr Ser Asn Phe Pro Gly Ala
          195          200          205
Leu Thr Val Ser Gly Gly Glu Leu Val Val Thr Glu Gly Ala Thr Leu
          210          215          220
Thr Thr Gly Thr Ile Thr Ala Thr Ser Gly Arg Val Thr Leu Gly Ser
          225          230          235          240
Gly Ala Ser Leu Ser Ala Val Ala Gly Ala Ala Asn Asn Asn Tyr Thr
          245          250          255
Cys Thr Val Ser Lys Leu Gly Ile Asp Leu Glu Ser Phe Leu Thr Pro
          260          265          270
Asn Tyr Lys Thr Ala Ile Leu Gly Ala Asp Gly Thr Val Thr Val Asn
          275          280          285
Ser Gly Ser Thr Leu Asp Leu Val Met Glu Asn Glu Ala Glu Val Tyr
          290          295          300
Asp Asn Pro Leu Phe Val Gly Ser Leu Thr Ile Pro Phe Val Thr Leu
          305          310          315          320

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Ser Ser Ser Ser Ala Ser Asn Gly Val Thr Lys Asn Ser Val Thr Ile  
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 Asn Asp Ala Asp Ala Ala His Tyr Gly Tyr Gln Gly Ser Trp Ser Ala  
 340 345 350  
 Asp Trp Thr Lys Pro Pro Leu Ala Pro Asp Ala Lys Gly Met Val Pro  
 355 360 365  
 Pro Asn Thr Asn Asn Thr Leu Tyr Leu Thr Trp Arg Pro Ala Ser Asn  
 370 375 380  
 Tyr Gly Glu Tyr Arg Leu Asp Pro Gln Arg Lys Gly Glu Leu Val Pro  
 385 390 395 400  
 Asn Ser Leu Trp Val Ala Gly Ser Ala Leu Arg Thr Phe Thr Asn Gly  
 405 410 415  
 Leu Lys Glu His Tyr Val Ser Arg Asp Val Gly Phe Val Ala Ser Leu  
 420 425 430  
 His Ala Leu Gly Asp Tyr Ile Leu Asn Tyr Thr Gln Asp Asp Arg Asp  
 435 440 445  
 Gly Phe Leu Ala Arg Tyr Gly Gly Phe Gln Ala Thr Ala Ala Ser His  
 450 455 460  
 Tyr Glu Asn Gly Ser Ile Phe Gly Val Ala Phe Gly Gln Leu Tyr Gly  
 465 470 475 480  
 Gln Thr Lys Ser Arg Met Tyr Tyr Ser Lys Asp Ala Gly Asn Met Thr  
 485 490 495  
 Met Leu Ser Cys Phe Gly Arg Ser Tyr Val Asp Ile Lys Gly Thr Glu  
 500 505 510  
 Thr Val Met Tyr Trp Glu Thr Ala Tyr Gly Tyr Ser Val His Arg Met  
 515 520 525  
 His Thr Gln Tyr Phe Asn Asp Lys Thr Gln Lys Phe Asp His Ser Lys  
 530 535 540  
 Cys His Trp His Asn Asn Asn Tyr Tyr Ala Phe Val Gly Ala Glu His  
 545 550 555 560  
 Asn Phe Leu Glu Tyr Cys Ile Pro Thr Arg Gln Leu Ala Arg Asp Tyr  
 565 570 575  
 Glu Leu Thr Gly Phe Met Arg Phe Glu Met Ala Gly Gly Trp Ser Ser  
 580 585 590  
 Ser Thr Arg Glu Thr Gly Ser Leu Thr Arg Tyr Phe Ala Arg Gly Ser  
 595 600 605  
 Gly His Asn Met Ser Leu Pro Ile Gly Ile Val Ala His Ala Val Ser  
 610 615 620  
 His Val Arg Arg Ser Pro Pro Ser Lys Leu Thr Leu Asn Met Gly Tyr  
 625 630 635 640  
 Arg Pro Asp Ile Trp Arg Val Thr Pro His Cys Asn Met Glu Ile Ile  
 645 650 655  
 Ala Asn Gly Val Lys Thr Pro Ile Gln Gly Ser Pro Leu Ala Arg His  
 660 665 670  
 Ala Phe Phe Leu Glu Val His Asp Thr Leu Tyr Ile His His Phe Gly  
 675 680 685  
 Arg Ala Tyr Met Asn Tyr Ser Leu Asp Ala Arg Arg Arg Gln Thr Ala  
 690 695 700  
 His Phe Val Ser Met Gly Leu Asn Arg Ile Phe  
 705 710 715

&lt;210&gt; 330

&lt;211&gt; 38

&lt;212&gt; DNA

&lt;213&gt; Chlymadia trachomatis

&lt;400&gt; 330

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38



<210> 331  
 <211> 34  
 <212> DNA  
 <213> Chlymadia trachomatis

<400> 331  
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<210> 332  
 <211> 1557  
 <212> DNA  
 <213> Chlymadia trachomatis

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 accgttcata tggggcctac cgcttctctc ggcttgggtg ttgtcgacaa caacggcaac 180  
 ggcgcacgag tccaacgcgt ggtcgggagc gtcctggcgg caagtctcgg catctccacc 240  
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 gtctctggta acgcatcttt cacaaaattt accaacattc ctactaccga tacaacaact 660  
 cccacgaact caaactcctc tagctctagc ggagaaactg cttccgtttc tgaggatagt 720  
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 aaaatgactg gtgaaggcgg tgctatcttc tctcaaggag agctgctatt tacagatctg 900  
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 <211> 518  
 <212> PRT  
 <213> Chlymadia trachomatis

<400> 333  
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 Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala  
 35 40 45  
 Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val  
 50 55 60  
 Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr  
 65 70 75 80

Gly	Asp	Val	Ile	Thr	Ala	Val	Asp	Gly	Ala	Pro	Ile	Asn	Ser	Ala	Thr
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Ala	Met	Ala	Asp	Ala	Leu	Asn	Gly	His	His	Pro	Gly	Asp	Val	Ile	Ser
			100					105					110		
Val	Thr	Trp	Gln	Thr	Lys	Ser	Gly	Gly	Thr	Arg	Thr	Gly	Asn	Val	Thr
		115					120					125			
Leu	Ala	Glu	Gly	Pro	Pro	Ala	Glu	Phe	Cys	Arg	Tyr	Pro	Ser	His	Trp
	130					135					140				
Arg	Pro	Leu	Met	Lys	Trp	Leu	Ser	Ala	Thr	Ala	Val	Phe	Ala	Ala	Val
145				150						155					160
Leu	Pro	Ser	Val	Ser	Gly	Phe	Cys	Phe	Pro	Glu	Pro	Lys	Glu	Leu	Asn
			165						170					175	
Phe	Ser	Arg	Val	Glu	Thr	Ser	Ser	Ser	Thr	Thr	Phe	Thr	Glu	Thr	Ile
		180						185					190		
Gly	Glu	Ala	Gly	Ala	Glu	Tyr	Ile	Val	Ser	Gly	Asn	Ala	Ser	Phe	Thr
		195					200					205			
Lys	Phe	Thr	Asn	Ile	Pro	Thr	Thr	Asp	Thr	Thr	Thr	Pro	Thr	Asn	Ser
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Asn	Ser	Ser	Ser	Ser	Ser	Gly	Glu	Thr	Ala	Ser	Val	Ser	Glu	Asp	Ser
225					230					235				240	
Asp	Ser	Thr	Thr	Thr	Thr	Pro	Asp	Pro	Lys	Gly	Gly	Gly	Ala	Phe	Tyr
			245						250					255	
Asn	Ala	His	Ser	Gly	Val	Leu	Ser	Phe	Met	Thr	Arg	Ser	Gly	Thr	Glu
		260						265					270		
Gly	Ser	Leu	Thr	Leu	Ser	Glu	Ile	Lys	Met	Thr	Gly	Glu	Gly	Gly	Ala
		275					280					285			
Ile	Phe	Ser	Gln	Gly	Glu	Leu	Leu	Phe	Thr	Asp	Leu	Thr	Ser	Leu	Thr
	290					295					300				
Ile	Gln	Asn	Asn	Leu	Ser	Gln	Leu	Ser	Gly	Gly	Ala	Ile	Phe	Gly	Gly
305				310						315				320	
Ser	Thr	Ile	Ser	Leu	Ser	Gly	Ile	Thr	Lys	Ala	Thr	Phe	Ser	Cys	Asn
			325						330					335	
Ser	Ala	Glu	Val	Pro	Ala	Pro	Val	Lys	Lys	Pro	Thr	Glu	Pro	Lys	Ala
		340						345					350		
Gln	Thr	Ala	Ser	Glu	Thr	Ser	Gly	Ser	Ser	Ser	Ser	Ser	Gly	Asn	Asp
		355					360					365			
Ser	Val	Ser	Ser	Pro	Ser	Ser	Ser	Arg	Ala	Glu	Pro	Ala	Ala	Ala	Asn
	370					375					380				
Leu	Gln	Ser	His	Phe	Ile	Cys	Ala	Thr	Ala	Thr	Pro	Ala	Ala	Gln	Thr
385				390						395					400
Asp	Thr	Glu	Thr	Ser	Thr	Pro	Ser	His	Lys	Pro	Gly	Ser	Gly	Gly	Ala
			405						410					415	
Ile	Tyr	Ala	Lys	Gly	Asp	Leu	Thr	Ile	Ala	Asp	Ser	Gln	Glu	Val	Leu
		420						425					430		
Phe	Ser	Ile	Asn	Lys	Al										

<211> 37  
 <212> DNA  
 <213> Chlymadia trachomatis

<400> 334  
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<210> 335  
 <211> 39  
 <212> DNA  
 <213> Chlamydia trachomatis

<400> 335  
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<210> 336  
 <211> 1758  
 <212> DNA  
 <213> Chlymadia trachomatis

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 ccatcacact ggcggccgct cggtgacctc tcaattcaat cttctaaaca gagtcttttt 480  
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 gcgacagatg ttggaggtgg tgcttacgta aaaggaaccc ttacttgtga aaactctcac 900  
 cgtctacaat ttttgaaaaa ctcttccgat aaacaagggtg gaggaatcta cggagaagac 960  
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<210> 337  
 <211> 585  
 <212> PRT  
 <213> Chlamydia trachomatis

<400> 337

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      20      25      30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
      35      40      45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
      50      55      60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
65      70      75      80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
      85      90      95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
      100      105      110
Val Thr Trp Gln Thr Lys Ser Gly Gly Thr Arg Thr Gly Asn Val Thr
      115      120      125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
130      135      140
Arg Pro Leu Gly Asp Leu Ser Ile Gln Ser Ser Lys Gln Ser Leu Phe
145      150      155      160
Asn Ser Asn Tyr Ser Lys Gln Gly Gly Gly Ala Leu Tyr Val Glu Gly
      165      170      175
Gly Ile Asn Phe Gln Asp Leu Glu Glu Ile Arg Ile Lys Tyr Asn Lys
      180      185      190
Ala Gly Thr Phe Glu Thr Lys Lys Ile Thr Leu Pro Ser Leu Lys Ala
      195      200      205
Gln Ala Ser Ala Gly Asn Ala Asp Ala Trp Ala Ser Ser Ser Pro Gln
210      215      220
Ser Gly Ser Gly Ala Thr Thr Val Ser Asp Ser Gly Asp Ser Ser Ser
225      230      235      240
Gly Ser Asp Ser Asp Thr Ser Glu Thr Val Pro Val Thr Ala Lys Gly
      245      250      255
Gly Gly Leu Tyr Thr Asp Lys Asn Leu Ser Ile Thr Asn Ile Thr Gly
      260      265      270
Ile Ile Glu Ile Ala Asn Asn Lys Ala Thr Asp Val Gly Gly Gly Ala
275      280      285
Tyr Val Lys Gly Thr Leu Thr Cys Glu Asn Ser His Arg Leu Gln Phe
290      295      300
Leu Lys Asn Ser Ser Asp Lys Gln Gly Gly Gly Ile Tyr Gly Glu Asp
305      310      315      320
Asn Ile Thr Leu Ser Asn Leu Thr Gly Lys Thr Leu Phe Gln Glu Asn
      325      330      335
Thr Ala Lys Glu Glu Gly Gly Gly Leu Phe Ile Lys Gly Thr Asp Lys
      340      345      350
Ala Leu Thr Met Thr Gly Leu Asp Ser Phe Cys Leu Ile Asn Asn Thr
355      360      365
Ser Glu Lys His Gly Gly Gly Ala Phe Val Thr Lys Glu Ile Ser Gln
370      375      380
Thr Tyr Thr Ser Asp Val Glu Thr Ile Pro Gly Ile Thr Pro Val His
385      390      395      400
Gly Glu Thr Val Ile Thr Gly Asn Lys Ser Thr Gly Gly Asn Gly Gly
      405      410      415
Gly Val Cys Thr Lys Arg Leu Ala Leu Ser Asn Leu Gln Ser Ile Ser
      420      425      430
Ile Ser Gly Asn Ser Ala Ala Glu Asn Gly Gly Gly Ala His Thr Cys
435      440      445
Pro Asp Ser Phe Pro Thr Ala Asp Thr Ala Glu Gln Pro Ala Ala Ala
450      455      460

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Ser Ala Ala Thr Ser Thr Pro Lys Ser Ala Pro Val Ser Thr Ala Leu  
 465 470 475 480  
 Ser Thr Pro Ser Ser Ser Thr Val Ser Ser Leu Thr Leu Leu Ala Ala  
 485 490 495  
 Ser Ser Gln Ala Ser Pro Ala Thr Ser Asn Lys Glu Thr Gln Asp Pro  
 500 505 510  
 Asn Ala Asp Thr Asp Leu Leu Ile Asp Tyr Val Val Asp Thr Thr Ile  
 515 520 525  
 Ser Lys Asn Thr Ala Lys Lys Gly Gly Gly Ile Tyr Ala Lys Lys Ala  
 530 535 540  
 Lys Met Ser Arg Ile Asp Gln Leu Asn Ile Ser Glu Asn Ser Ala Thr  
 545 550 555 560  
 Glu Ile Gly Gly Gly Ile Cys Cys Lys Glu Ser Leu Glu Leu Asp Ala  
 565 570 575  
 Leu Val Ser Leu Ser Val Thr Glu Asn  
 580 585

&lt;210&gt; 338

&lt;211&gt; 38

&lt;212&gt; DNA

&lt;213&gt; Chlamydai trachomatis

&lt;400&gt; 338

gagagcggcc gctcgaccaa ctgaatatct ctgagaac

38

&lt;210&gt; 339

&lt;211&gt; 35

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 339

gagagcggcc gcttaagaga ctacgtggag ttctg

35

&lt;210&gt; 340

&lt;211&gt; 1965

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 340

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 ggcgcacgag tccaacgcgt ggtcgggagc gtcgccggcg caagtctcgg catctccacc 240  
 ggcgacgtga tcaccgcgt cgacggcgct ccgatcaact cggccaccgc gatggcggac 300  
 gcgcttaacg ggcacatcc cgggtgacgt atctcgggtga cctggcaaac caagtcgggc 360  
 ggcacgcgta cagggaacgt gacattggcc gagggacccc cggccgaatt ctgcagatat 420  
 ccatcacact ggcgccgct cgaccaactg aatatctctg agaactccgc tacagagata 480  
 ggtggaggta tctgctgtaa agaattctta gaactagatg ctctagtctc cttatctgta 540  
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 aatctgaaat caggcttctc tttctcgaac aacaaagcaa actcctcatc cacaggagtc 660  
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 gttacattga attgtcctgc gacattctct aacaatacag cctctatagc tacaccgaag 1080  
 acttcttctg aagatggatc ctcaggaaat tctattaaag ataccattgg aggagccatt 1140

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gcagggacag ccattaccct atctggagtc tctcgatttt caggggaatac ggctgattta 1200
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tcttctgaat tacatgaaaa caaatcttac atcccacaga atgcaatcct tcacaacgga 1920
acttttagttc ttaaagagaa aacagaactc cacgtagtct cttaa 1965

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&lt;210&gt; 341

&lt;211&gt; 654

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 341

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Met His His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
 1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
          20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
          35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
          50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
          85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
          100          105          110
Val Thr Trp Gln Thr Lys Ser Gly Thr Arg Thr Gly Asn Val Thr
          115          120          125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
          130          135          140
Arg Pro Leu Asp Gln Leu Asn Ile Ser Glu Asn Ser Ala Thr Glu Ile
145          150          155          160
Gly Gly Gly Ile Cys Cys Lys Glu Ser Leu Glu Leu Asp Ala Leu Val
          165          170          175
Ser Leu Ser Val Thr Glu Asn Leu Val Gly Lys Glu Gly Gly Gly Leu
          180          185          190
His Ala Lys Thr Val Asn Ile Ser Asn Leu Lys Ser Gly Phe Ser Phe
          195          200          205
Ser Asn Asn Lys Ala Asn Ser Ser Ser Thr Gly Val Ala Thr Thr Ala
          210          215          220
Ser Ala Pro Ala Ala Ala Ala Ala Ser Leu Gln Ala Ala Ala Ala Ala
225          230          235          240
Ala Pro Ser Ser Pro Ala Thr Pro Thr Tyr Ser Gly Val Val Gly Gly
          245          250          255
Ala Ile Tyr Gly Glu Lys Val Thr Phe Ser Gln Cys Ser Gly Thr Cys
          260          265          270
Gln Phe Ser Gly Asn Gln Ala Ile Asp Asn Asn Pro Ser Gln Ser Ser
          275          280          285
Leu Asn Val Gln Gly Gly Ala Ile Tyr Ala Lys Thr Ser Leu Ser Ile

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290		295		300
Gly Ser Ser Asp Ala	Gly Thr Ser Tyr Ile	Phe Ser Gly Asn Ser Val		
305	310	315		320
Ser Thr Gly Lys Ser	Gln Thr Thr Gly Gln	Ile Ala Gly Gly Ala Ile		
	325	330		335
Tyr Ser Pro Thr Val	Thr Leu Asn Cys Pro	Ala Thr Phe Ser Asn Asn		
	340	345		350
Thr Ala Ser Ile Ala	Thr Pro Lys Thr Ser	Ser Glu Asp Gly Ser Ser		
	355	360		365
Gly Asn Ser Ile Lys	Asp Thr Ile Gly Gly	Ala Ile Ala Gly Thr Ala		
	370	375		380
Ile Thr Leu Ser Gly	Val Ser Arg Phe Ser	Gly Asn Thr Ala Asp Leu		
385	390	395		400
Gly Ala Ala Ile Gly	Thr Leu Ala Asn Ala	Asn Thr Pro Ser Ala Thr		
	405	410		415
Ser Gly Ser Gln Asn	Ser Ile Thr Glu Lys	Ile Thr Leu Glu Asn Gly		
	420	425		430
Ser Phe Ile Phe Glu	Arg Asn Gln Ala Asn	Lys Arg Gly Ala Ile Tyr		
	435	440		445
Ser Pro Ser Val Ser	Ile Lys Gly Asn Asn	Ile Thr Phe Asn Gln Asn		
	450	455		460
Thr Ser Thr His Asp	Gly Ser Ala Ile Tyr	Phe Thr Lys Asp Ala Thr		
465	470	475		480
Ile Glu Ser Leu Gly	Ser Val Leu Phe Thr	Gly Asn Asn Val Thr Ala		
	485	490		495
Thr Gln Ala Ser Ser	Ala Thr Ser Gly Gln	Asn Thr Asn Thr Ala Asn		
	500	505		510
Tyr Gly Ala Ala Ile	Phe Gly Asp Pro Gly	Thr Thr Gln Ser Ser Gln		
	515	520		525
Thr Asp Ala Ile Leu	Thr Leu Leu Ala Ser	Ser Gly Asn Ile Thr Phe		
	530	535		540
Ser Asn Asn Ser Leu	Gln Asn Asn Gln Gly	Asp Thr Pro Ala Ser Lys		
545	550	555		560
Phe Cys Ser Ile Ala	Gly Tyr Val Lys Leu	Ser Leu Gln Ala Ala Lys		
	565	570		575
Gly Lys Thr Ile Ser	Phe Phe Asp Cys Val	His Thr Ser Thr Lys Lys		
	580	585		590
Thr Gly Ser Thr Gln	Asn Val Tyr Glu Thr	Leu Asp Ile Asn Lys Glu		
	595	600		605
Glu Asn Ser Asn Pro	Tyr Thr Gly Thr Ile	Val Phe Ser Ser Glu Leu		
	610	615		620
His Glu Asn Lys Ser	Tyr Ile Pro Gln Asn	Ala Ile Leu His Asn Gly		
625	630	635		640
Thr Leu Val Leu Lys	Glu Lys Thr Glu Leu	His Val Val Ser		
	645	650		

&lt;210&gt; 342

&lt;211&gt; 36

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 342

gagagcgcc gctcggaact attgtgttct cttctg

36

&lt;210&gt; 343

&lt;211&gt; 35

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

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<210> 344  
<211> 2103  
<212> DNA  
<213> Chlamydia trachomatis

<400> 344  
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accgttcata tcgggcctac cgccttcctc ggcttgggtg ttgtcgacaa caacggcaac 180  
ggcgacagag tccaacgcgt ggtcgggagc gctccggcgg caagtctcgg catctccacc 240  
ggcgacgtga tcaccgcggt cgacggcgct cggatcaact cggccaccgc gatggcggac 300  
gcgcttaacg ggcattcatc cggtagcgtc atctcggtag cctggcaaac caagtcgggc 360  
ggcacgcgta cagggaacgt gacattggcc gagggacccc cggccgaatt ctgcagatat 420  
ccatcacact ggccggccgct cggaactatt gtgttctctt ctgaattaca tgaaaacaaa 480  
tcttacatcc cacagaatgc aatccttcac aacggaactt tagttcttaa agagaaaaca 540  
gaactccacg tagtctcttt tgagcagaaa gaagggtcta aattaattat ggaaccgcga 600  
gctgtgttat ctaacccaaa catagctaac ggagctctag ctatcaatgg gttaacgatt 660  
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gcagaataca gtactcaact atatcttggg cccttctgga ctctctacgg aaactatact 2040  
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taa 2103

<210> 345  
<211> 700  
<212> PRT  
<213> Chlamydia trachomatis

<400> 345  
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Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala  
20 25 30  
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala



35	40	45
Phe Leu Gly Leu Gly Val	Val Asp Asn Asn Gly	Asn Gly Ala Arg Val
50	55	60
Gln Arg Val Val Gly Ser	Ala Pro Ala Ala Ser	Leu Gly Ile Ser Thr
65	70	75
Gly Asp Val Ile Thr Ala	Val Asp Gly Ala Pro	Ile Asn Ser Ala Thr
85	90	95
Ala Met Ala Asp Ala Leu	Asn Gly His His Pro	Gly Asp Val Ile Ser
100	105	110
Val Thr Trp Gln Thr Lys	Ser Gly Gly Thr Arg	Thr Gly Asn Val Thr
115	120	125
Leu Ala Glu Gly Pro Pro	Ala Glu Phe Cys Arg	Tyr Pro Ser His Trp
130	135	140
Arg Pro Leu Gly Thr Ile	Val Phe Ser Ser Glu	Leu His Glu Asn Lys
145	150	155
Ser Tyr Ile Pro Gln Asn	Ala Ile Leu His Asn	Gly Thr Leu Val Leu
165	170	175
Lys Glu Lys Thr Glu Leu	His Val Val Ser Phe	Glu Gln Lys Glu Gly
180	185	190
Ser Lys Leu Ile Met Glu	Pro Gly Ala Val Leu	Ser Asn Gln Asn Ile
195	200	205
Ala Asn Gly Ala Leu Ala	Ile Asn Gly Leu Thr	Ile Asp Leu Ser Ser
210	215	220
Met Gly Thr Pro Gln Ala	Gly Glu Ile Phe Ser	Pro Pro Glu Leu Arg
225	230	235
Ile Val Ala Thr Thr Ser	Ser Ala Ser Gly Gly	Ser Gly Val Ser Ser
245	250	255
Ser Ile Pro Thr Asn Pro	Lys Arg Ile Ser Ala	Ala Val Pro Ser Gly
260	265	270
Ser Ala Ala Thr Thr Pro	Thr Met Ser Glu Asn	Lys Val Phe Leu Thr
275	280	285
Gly Asp Leu Thr Leu Ile	Asp Pro Asn Gly Asn	Phe Tyr Gln Asn Pro
290	295	300
Met Leu Gly Ser Asp Leu	Asp Val Pro Leu Ile	Lys Leu Pro Thr Asn
305	310	315
Thr Ser Asp Val Gln Val	Tyr Asp Leu Thr Leu	Ser Gly Asp Leu Phe
325	330	335
Pro Gln Lys Gly Tyr Met	Gly Thr Trp Thr Leu	Asp Ser Asn Pro Gln
340	345	350
Thr Gly Lys Leu Gln Ala	Arg Trp Thr Phe Asp	Thr Tyr Arg Arg Trp
355	360	365
Val Tyr Ile Pro Arg Asp	Asn His Phe Tyr Ala	Asn Ser Ile Leu Gly
370	375	380
Ser Gln Asn Ser Met Ile	Val Val Lys Gln Gly	Leu Ile Asn Asn Met
385	390	395
Leu Asn Asn Ala Arg Phe	Asp Asp Ile Ala Tyr	Asn Asn Phe Trp Val
405	410	415
Ser Gly Val Gly Thr Phe	Leu Ala Gln Gln Gly	Thr Pro Leu Ser Glu
420	425	430
Glu Phe Ser Tyr Tyr Ser	Arg Gly Thr Ser Val	Ala Ile Asp Ala Lys
435	440	445
Pro Arg Gln Asp Phe Ile	Leu Gly Ala Ala Phe	Ser Lys Ile Val Gly
450	455	460
Lys Thr Lys Ala Ile Lys	Lys Met His Asn Tyr	Phe His Lys Gly Ser
465	470	475
Glu Tyr Ser Tyr Gln Ala	Ser Val Tyr Gly Gly	Lys Phe Leu Tyr Phe
485	490	495
Leu Leu Asn Lys Gln His	Gly Trp Ala Leu Pro	Phe Leu Ile Gln Gly

			500								505								510		
Val	Val	Ser	Tyr	Gly	His	Ile	Lys	His	Asp	Thr	Thr	Thr	Leu	Tyr	Pro						
		515					520					525									
Ser	Ile	His	Glu	Arg	Asn	Lys	Gly	Asp	Trp	Glu	Asp	Leu	Gly	Trp	Leu						
	530				535						540										
Ala	Asp	Leu	Arg	Ile	Ser	Met	Asp	Leu	Lys	Glu	Pro	Ser	Lys	Asp	Ser						
545					550					555					560						
Ser	Lys	Arg	Ile	Thr	Val	Tyr	Gly	Glu	Leu	Glu	Tyr	Ser	Ser	Ile	Arg						
			565						570					575							
Gln	Lys	Gln	Phe	Thr	Glu	Ile	Asp	Tyr	Asp	Pro	Arg	His	Phe	Asp	Asp						
			580				585						590								
Cys	Ala	Tyr	Arg	Asn	Leu	Ser	Leu	Pro	Val	Gly	Cys	Ala	Val	Glu	Gly						
	595						600					605									
Ala	Ile	Met	Asn	Cys	Asn	Ile	Leu	Met	Tyr	Asn	Lys	Leu	Ala	Leu	Ala						
	610				615						620										
Tyr	Met	Pro	Ser	Ile	Tyr	Arg	Asn	Asn	Pro	Val	Cys	Lys	Tyr	Arg	Val						
625				630						635				640							
Leu	Ser	Ser	Asn	Glu	Ala	Gly	Gln	Val	Ile	Cys	Gly	Val	Pro	Thr	Arg						
			645						650					655							
Thr	Ser	Ala	Arg	Ala	Glu	Tyr	Ser	Thr	Gln	Leu	Tyr	Leu	Gly	Pro	Phe						
		660					665						670								
Trp	Thr	Leu	Tyr	Gly	Asn	Tyr	Thr	Ile	Asp	Val	Gly	Met	Tyr	Thr	Leu						
	675					680						685									
Ser	Gln	Met	Thr	Ser	Cys	Gly	Ala	Arg	Met	Ile	Phe										
	690				695						700										

<210> 346

<211> 37

<212> DNA

<213> Chlamydia trachomatis

<400> 346

gagagcggcc gctcatgaaa tttatgtcag ctactgc

37

<210> 347

<211> 37

<212> DNA

<213> Chlamydia trachomatis

<400> 347

gagagcggcc gcttaccctg taattccagt gatggtc

37

<210> 348

<211> 1464

<212> DNA

<213> Chlamydia trachomatis

<400> 348

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accgttcata	tcgggcctac	cgcttctctc	ggcttgggtg	ttgtcgacaa	caacggcaac	180
ggcgacgag	tccaacgcgt	ggtcggggagc	gctccggcgg	caagtctcgg	catctccacc	240
ggcgacgtga	tcaccgcggt	cgacgggcgt	ccgatcaact	cggccaccgc	gatggcggac	300
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ggcacgcgta	cagggaaacgt	gacattggcc	gagggacccc	cggccgaatt	ctgcagatat	420
ccatcacact	ggcggcgcgt	catgaaattt	atgtcagcta	ctcgtgtatt	tgctgcagta	480
ctctctctcg	ttactgaggc	gagctcgatc	caagatcaaa	taagaataac	cgactgcaat	540
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tcttcatctg gagaaaatac tgagaattca caagattcag ctccctcttc tggagaaact 780
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actcctagcc ccgacgatgt tttaggtaaa ggtgggtggta tctatacaga aaaatctttg 1440
accatcactg gaattacagg gtaa 1464

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&lt;210&gt; 349

&lt;211&gt; 487

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 349

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Met His His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
 1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
 20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
 35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
 50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
 65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
 85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
100          105          110
Val Thr Trp Gln Thr Lys Ser Gly Thr Arg Thr Gly Asn Val Thr
115          120          125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
130          135          140
Arg Pro Leu Met Lys Phe Met Ser Ala Thr Ala Val Phe Ala Ala Val
145          150          155          160
Leu Ser Ser Val Thr Glu Ala Ser Ser Ile Gln Asp Gln Ile Lys Asn
165          170          175
Thr Asp Cys Asn Val Ser Lys Val Gly Tyr Ser Thr Ser Gln Ala Phe
180          185          190
Thr Asp Met Met Leu Ala Asp Asn Thr Glu Tyr Arg Ala Ala Asp Ser
195          200          205
Val Ser Phe Tyr Asp Phe Ser Thr Ser Ser Gly Leu Pro Arg Lys His
210          215          220
Leu Ser Ser Ser Ser Glu Ala Ser Pro Thr Thr Glu Gly Val Ser Ser
225          230          235          240
Ser Ser Ser Gly Glu Asn Thr Glu Asn Ser Gln Asp Ser Ala Pro Ser
245          250          255
Ser Gly Glu Thr Asp Lys Lys Thr Glu Glu Glu Leu Asp Asn Gly Gly
260          265          270
Ile Ile Tyr Ala Arg Glu Lys Leu Thr Ile Ser Glu Ser Gln Asp Ser
275          280          285

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Leu Ser Asn Pro Ser Ile Glu Leu His Asp Asn Ser Phe Phe Phe Gly  
 290 295 300  
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 305 310 315 320  
 Ala Ile Tyr Gly Glu Lys Glu Val Val Phe Glu Asn Ile Lys Ser Leu  
 325 330 335  
 Leu Val Glu Val Asn Ile Ser Val Glu Lys Gly Gly Ser Val Tyr Ala  
 340 345 350  
 Lys Glu Arg Val Ser Leu Glu Asn Val Thr Glu Ala Thr Phe Ser Ser  
 355 360 365  
 Asn Gly Gly Glu Gln Gly Gly Gly Ile Tyr Ser Glu Gln Asp Met  
 370 375 380  
 Leu Ile Ser Asp Cys Asn Asn Val His Phe Gln Gly Asn Ala Ala Gly  
 385 390 395 400  
 Ala Thr Ala Val Lys Gln Cys Leu Asp Glu Glu Met Ile Val Leu Leu  
 405 410 415  
 Thr Glu Cys Val Asp Ser Leu Ser Glu Asp Thr Leu Asp Ser Thr Pro  
 420 425 430  
 Glu Thr Glu Gln Thr Lys Ser Asn Gly Asn Gln Asp Gly Ser Ser Glu  
 435 440 445  
 Thr Lys Asp Thr Gln Val Ser Glu Ser Pro Glu Ser Thr Pro Ser Pro  
 450 455 460  
 Asp Asp Val Leu Gly Lys Gly Gly Gly Ile Tyr Thr Glu Lys Ser Leu  
 465 470 475 480  
 Thr Ile Thr Gly Ile Thr Gly  
 485

&lt;210&gt; 350

&lt;211&gt; 37

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 350

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37

&lt;210&gt; 351

&lt;211&gt; 37

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 351

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37

&lt;210&gt; 352

&lt;211&gt; 1752

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 352

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 ccatcacact ggccggccgt cgatacacia gtatcagaat caccagaatc aactcctagc 480  
 cccgacgatg ttttaggtaa aggtggtggt atctatacag aaaaatcttt gaccatcact 540

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tcgtcctctt aa 1752

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&lt;210&gt; 353

&lt;211&gt; 583

&lt;212&gt; PRT

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 353

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Met His His His His His His Thr Ala Ala Ser Asp Asn Phe Gln Leu
 1          5          10          15
Ser Gln Gly Gly Gln Gly Phe Ala Ile Pro Ile Gly Gln Ala Met Ala
 20          25          30
Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala
 35          40          45
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val
 50          55          60
Gln Arg Val Val Gly Ser Ala Pro Ala Ala Ser Leu Gly Ile Ser Thr
 65          70          75          80
Gly Asp Val Ile Thr Ala Val Asp Gly Ala Pro Ile Asn Ser Ala Thr
 85          90          95
Ala Met Ala Asp Ala Leu Asn Gly His His Pro Gly Asp Val Ile Ser
 100          105          110
Val Thr Trp Gln Thr Lys Ser Gly Gly Thr Arg Thr Gly Asn Val Thr
 115          120          125
Leu Ala Glu Gly Pro Pro Ala Glu Phe Cys Arg Tyr Pro Ser His Trp
 130          135          140
Arg Pro Leu Asp Thr Gln Val Ser Glu Ser Pro Glu Ser Thr Pro Ser
 145          150          155          160
Pro Asp Asp Val Leu Gly Lys Gly Gly Gly Ile Tyr Thr Glu Lys Ser
 165          170          175
Leu Thr Ile Thr Gly Ile Thr Gly Thr Ile Asp Phe Val Ser Asn Ile
 180          185          190
Ala Thr Asp Ser Gly Ala Gly Val Phe Thr Lys Glu Asn Leu Ser Cys
 195          200          205
Thr Asn Thr Asn Ser Leu Gln Phe Leu Lys Asn Ser Ala Gly Gln His
 210          215          220
Gly Gly Gly Ala Tyr Val Thr Gln Thr Met Ser Val Thr Asn Thr Thr
 225          230          235          240

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168

Ser Glu Ser Ile Thr Thr Pro Pro Leu Val Gly Glu Val Ile Phe Ser  
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 Glu Asn Thr Ala Lys Gly His Gly Gly Ile Cys Thr Asn Lys Leu  
 260 265 270  
 Ser Leu Ser Asn Leu Lys Thr Val Thr Leu Thr Lys Asn Ser Ala Lys  
 275 280 285  
 Glu Ser Gly Gly Ala Ile Phe Thr Asp Leu Ala Ser Ile Pro Thr Thr  
 290 295 300  
 Asp Thr Pro Glu Ser Ser Thr Pro Ser Ser Ser Pro Ala Ser Thr  
 305 310 315 320  
 Pro Glu Val Val Ala Ser Ala Lys Ile Asn Arg Phe Phe Ala Ser Thr  
 325 330 335  
 Ala Glu Pro Ala Ala Pro Ser Leu Thr Glu Ala Glu Ser Asp Gln Thr  
 340 345 350  
 Asp Gln Thr Glu Thr Ser Asp Thr Asn Ser Asp Ile Asp Val Ser Ile  
 355 360 365  
 Glu Asn Ile Leu Asn Val Ala Ile Asn Gln Asn Thr Ser Ala Lys Lys  
 370 375 380  
 Gly Gly Ala Ile Tyr Gly Lys Lys Ala Lys Leu Ser Arg Ile Asn Asn  
 385 390 395 400  
 Leu Glu Leu Ser Gly Asn Ser Ser Gln Asp Val Gly Gly Gly Leu Cys  
 405 410 415  
 Leu Thr Glu Ser Val Glu Phe Asp Ala Ile Gly Ser Leu Leu Ser His  
 420 425 430  
 Tyr Asn Ser Ala Ala Lys Glu Gly Gly Val Ile His Ser Lys Thr Val  
 435 440 445  
 Thr Leu Ser Asn Leu Lys Ser Thr Phe Thr Phe Ala Asp Asn Thr Val  
 450 455 460  
 Lys Ala Ile Val Glu Ser Thr Pro Glu Ala Pro Glu Glu Ile Pro Pro  
 465 470 475 480  
 Val Glu Gly Glu Glu Ser Thr Ala Thr Glu Asn Pro Asn Ser Asn Thr  
 485 490 495  
 Glu Gly Ser Ser Ala Asn Thr Asn Leu Glu Gly Ser Gln Gly Asp Thr  
 500 505 510  
 Ala Asp Thr Gly Thr Gly Val Val Asn Asn Glu Ser Gln Asp Thr Ser  
 515 520 525  
 Asp Thr Gly Asn Ala Glu Ser Gly Glu Gln Leu Gln Asp Ser Thr Gln  
 530 535 540  
 Ser Asn Glu Glu Asn Thr Leu Pro Asn Ser Ser Ile Asp Gln Ser Asn  
 545 550 555 560  
 Glu Asn Thr Asp Glu Ser Ser Asp Ser His Thr Glu Glu Ile Thr Asp  
 565 570 575  
 Glu Ser Val Ser Ser Ser  
 580

&lt;210&gt; 354

&lt;211&gt; 39

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

&lt;400&gt; 354

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39

&lt;210&gt; 355

&lt;211&gt; 36

&lt;212&gt; DNA

&lt;213&gt; Chlamydia trachomatis

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36

<210> 356  
<211> 2052  
<212> DNA  
<213> Chlamydia trachomatis

<400> 356  
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cacactgagg aaataactga cgagagtgtc tcatcgtcct ctaaaagtgg atcatctact 540  
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gttgcagacc tcggatctgc tattgggttg gtgccagaca cacaaaatac agaaacagtg 1260  
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tacgcacctg tcgtttccat taaagcctat actgcgacat ttaacccaaa cagatctcta 1380  
gaagaaggaa gcgcgattta ctttacaaaa gaagcatcta ttgagtcttt aggctctggt 1440  
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<210> 357  
<211> 683  
<212> PRT  
<213> Chlamydia trachomatis

<400> 357  
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Ile Ala Gly Gln Ile Lys Leu Pro Thr Val His Ile Gly Pro Thr Ala  
35 40 45  
Phe Leu Gly Leu Gly Val Val Asp Asn Asn Gly Asn Gly Ala Arg Val

50		55		60
Gln Arg Val Val Gly	Ser Ala Pro Ala Ala	Ser Leu Gly Ile Ser Thr		
65	70	75	80	
Gly Asp Val Ile Thr	Ala Val Asp Gly Ala	Pro Ile Asn Ser Ala Thr		
	85	90	95	
Ala Met Ala Asp Ala	Leu Asn Gly His His	Pro Gly Asp Val Ile Ser		
	100	105	110	
Val Thr Trp Gln Thr	Lys Ser Gly Gly Thr	Arg Thr Gly Asn Val Thr		
	115	120	125	
Leu Ala Glu Gly Pro	Pro Ala Glu Phe Cys	Arg Tyr Pro Ser His Trp		
	130	135	140	
Arg Pro Leu Asp Gln	Ser Asn Glu Asn Thr	Asp Glu Ser Ser Asp Ser		
145	150	155	160	
His Thr Glu Glu Ile	Thr Asp Glu Ser Val	Ser Ser Ser Ser Lys Ser		
	165	170	175	
Gly Ser Ser Thr Pro	Gln Asp Gly Gly Ala	Ala Ser Ser Gly Ala Pro		
	180	185	190	
Ser Gly Asp Gln Ser	Ile Ser Ala Asn Ala	Cys Leu Ala Lys Ser Tyr		
	195	200	205	
Ala Ala Ser Thr Asp	Ser Ser Pro Val Ser	Asn Ser Ser Gly Ser Asp		
	210	215	220	
Val Thr Ala Ser Ser	Asp Asn Pro Asp Ser	Ser Ser Ser Gly Asp Ser		
225	230	235	240	
Ala Gly Asp Ser Glu	Gly Pro Thr Glu Pro	Glu Ala Gly Ser Thr Thr		
	245	250	255	
Glu Thr Pro Thr Leu	Ile Gly Gly Gly Ala	Ile Tyr Gly Glu Thr Val		
	260	265	270	
Lys Ile Glu Asn Phe	Ser Gly Gln Gly Ile	Phe Ser Gly Asn Lys Ala		
	275	280	285	
Ile Asp Asn Thr Thr	Glu Gly Ser Ser Ser	Lys Ser Asn Val Leu Gly		
	290	295	300	
Gly Ala Val Tyr Ala	Lys Thr Leu Phe Asn	Leu Asp Ser Gly Ser Ser		
305	310	315	320	
Arg Arg Thr Val Thr	Phe Ser Gly Asn Thr	Val Ser Ser Gln Ser Thr		
	325	330	335	
Thr Gly Gln Val Ala	Gly Gly Ala Ile Tyr	Ser Pro Thr Val Thr Ile		
	340	345	350	
Ala Thr Pro Val Val	Phe Ser Lys Asn Ser	Ala Thr Asn Asn Ala Asn		
	355	360	365	
Asn Ala Thr Asp Thr	Gln Arg Lys Asp Thr	Phe Gly Gly Ala Ile Gly		
	370	375	380	
Ala Thr Ser Ala Val	Ser Leu Ser Gly Gly	Ala His Phe Leu Glu Asn		
385	390	395	400	
Val Ala Asp Leu Gly	Ser Ala Ile Gly Leu	Val Pro Asp Thr Gln Asn		
	405	410	415	
Thr Glu Thr Val Lys	Leu Glu Ser Gly Ser	Tyr Tyr Phe Glu Lys Asn		
	420	425	430	
Lys Ala Leu Lys Arg	Ala Thr Ile Tyr Ala	Pro Val Val Ser Ile Lys		
	435	440	445	
Ala Tyr Thr Ala Thr	Phe Asn Gln Asn Arg	Ser Leu Glu Glu Gly Ser		
	450	455	460	
Ala Ile Tyr Phe Thr	Lys Glu Ala Ser Ile	Glu Ser Leu Gly Ser Val		
465	470	475	480	
Leu Phe Thr Gly Asn	Leu Val Thr Pro Thr	Leu Ser Thr Thr Thr Glu		
	485	490	495	
Gly Thr Pro Ala Thr	Thr Ser Gly Asp Val	Thr Lys Tyr Gly Ala Ala		
	500	505	510	
Ile Phe Gly Gln Ile	Ala Ser Ser Asn Gly	Ser Gln Thr Asp Asn Leu		



515	520	525
Pro Leu Lys Leu Ile Ala Ser Gly Gly Asn Ile Cys Phe Arg Asn Asn		
530	535	540
Glu Tyr Arg Pro Thr Ser Ser Asp Thr Gly Thr Ser Thr Phe Cys Ser		
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Ile Ala Gly Asp Val Lys Leu Thr Met Gln Ala Ala Lys Gly Lys Thr		560
565	570	575
Ile Ser Phe Phe Asp Ala Ile Arg Thr Ser Thr Lys Lys Thr Gly Thr		
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Gln Ala Thr Ala Tyr Asp Thr Leu Asp Ile Asn Lys Ser Glu Asp Ser		
595	600	605
Glu Thr Val Asn Ser Ala Phe Thr Gly Thr Ile Leu Phe Ser Ser Glu		
610	615	620
Leu His Glu Asn Lys Ser Tyr Ile Pro Gln Asn Val Val Leu His Ser		
625	630	635
Gly Ser Leu Val Leu Lys Pro Asn Thr Glu Leu His Val Ile Ser Phe		640
645	650	655
Glu Gln Lys Glu Gly Ser Ser Leu Val Met Thr Pro Gly Ser Val Leu		
660	665	670
Ser Asn Gln Thr Val Ala Asp Gly Ala Leu Val		
675	680	